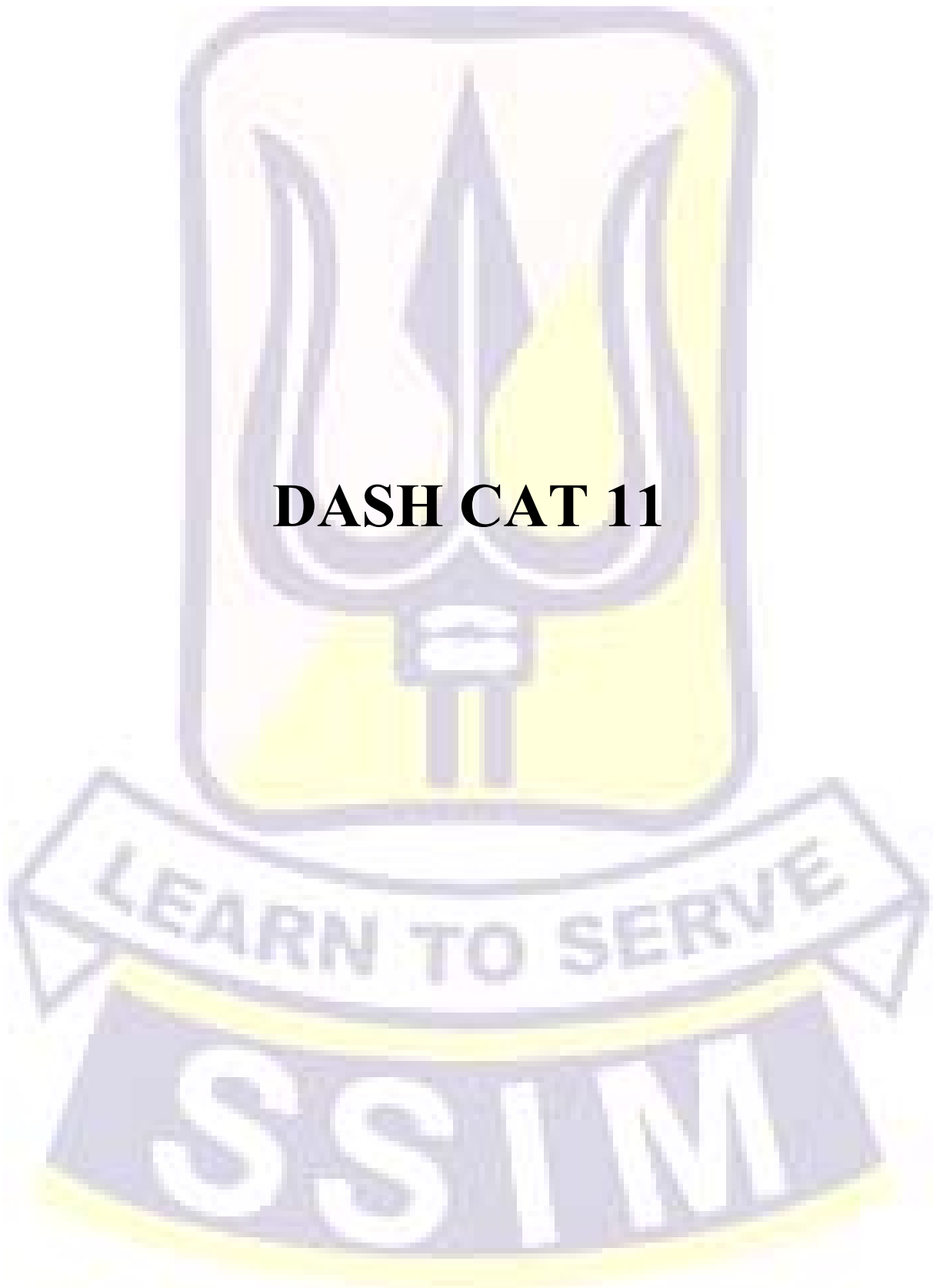




DASH CAT 11





DASH CAT 11

Instructions

The passage below is accompanied by a set of questions. Choose the best answer to each question.

Critical race theory is an academic concept that is more than 40 years old. The core idea is that race is a social construct and that racism is not merely the product of individual bias or prejudice, but also something embedded in legal systems and policies. A good example is when, in the 1930s, government officials literally drew lines around areas deemed poor financial risks, often explicitly due to the racial composition of inhabitants. Banks subsequently refused to offer mortgages to Black people in those areas. Today, those same patterns of discrimination live on through facially race-blind policies, like single-family zoning that prevents the building of affordable housing in advantaged, majority-white neighborhoods and, thus, stymies racial desegregation efforts.

CRT also has ties to other intellectual currents, including the work of sociologists and literary theorists who studied links between political power, social organization, and language. And its ideas have since informed other fields, like the humanities, the social sciences, and teacher education. This academic understanding of critical race theory differs from representation in recent popular books and, especially, from its portrayal by critics—often, though not exclusively, conservative Republicans. Critics charge that the theory leads to negative dynamics, such as a focus on group identity over universal, shared traits; divides people into “oppressed” and “oppressor” groups; and urges intolerance. Thus, there is a good deal of confusion over what CRT means, as well as its relationship to other terms, like “anti-racism” and “social justice,” with which it is often conflated.

[...] Some critics claim that the theory advocates discriminating against white people in order to achieve equity. They mainly aim those accusations at theorists who advocate for policies that explicitly take race into account. (The writer Ibram X. Kendi, whose recent popular book *How to Be An Antiracist* suggests that discrimination that creates equity can be considered anti-racist, is often cited in this context.)

Fundamentally, though, the disagreement springs from different conceptions of racism. CRT puts an emphasis on outcomes, not merely on individuals’ own beliefs, and it calls on these outcomes to be examined and rectified. Among lawyers, teachers, policymakers, and the general public, there are many disagreements about how precisely to do those things, and to what extent race should be explicitly appealed to or referred to in the process.

Here’s a helpful illustration to keep in mind in understanding this complex idea. In a 2007 U.S. Supreme Court school-assignment case on whether race could be a factor in maintaining diversity in K-12 schools, Chief Justice John Roberts’ opinion famously concluded: “The way to stop discrimination on the basis of race is to stop discriminating on the basis of race.” But during oral arguments, then-justice Ruth Bader Ginsburg said: “It’s very hard for me to see how you can have a racial objective but a nonracial means to get there.”

[...] As with CRT in general, its popular representation in schools has been far less nuanced. A recent poll by the advocacy group Parents Defending Education claimed some schools were teaching that “white people are inherently privileged, while Black and other people of color are inherently oppressed and victimized”; that “achieving racial justice and equality between racial groups requires discriminating against people based on their whiteness”; and that “the United States was founded on racism.”



1. 'Facially race-blind' policies would refer to the policies that:

- A. do not have race as an important criterion of judgment.
- B. do not see race and consider all races to be equal before them.
- C. appear to be free of racial bias but are actually not.
- D. are blind to the interests of certain races.

Sol. *Today, those same patterns of discrimination live on through facially race-blind policies, like single-family zoning that prevents the building of affordable housing in advantaged, majority-white neighborhoods and, thus, stymies racial desegregation efforts.*

The author states that the patterns of discrimination live on through facially race-blind policies. This refers to the fact that these policies appear race-neutral, that is, they are unbiased on the surface. However, they are problematic on a deeper level. Thus, Option C is the correct answer.

Options A and B give a positive connotation to such policies, which has not been implied by the author. They can be eliminated.

Option D is a distortion. 'race-blind' means that a policy does not distinguish between races. Hence, Option D can be eliminated too.

2. Which of the following can be inferred to be true about CRT from the passage?

- A. It finds support in many historical governmental policies.
- B. It propagates a group identity over a universal one.
- C. It does not put the onus of racial discrimination on personal bias.
- D. The criticism of CRT is not restricted to a particular end of the political spectrum.

Sol. A: The author offers one example that supports CRT. We cannot say if many historical governmental policies follow the same path. Option A cannot be inferred.

B: Option B has not been stated with certainty in the passage. It is a charge made by the critics of CRT - however, we cannot say if this charge is valid or not.

C: *The core idea is that race is a social construct and that racism is **not merely** the product of individual bias or prejudice, **but also** something embedded in legal systems and policies.*

We cannot say that the onus is not being put on personal bias, but that the onus is also being put on another factor. 'not merely... but also' implies that social constructs along with individual bias support racism. Thus, Option C cannot be inferred to be true.

D: *This academic understanding of critical race theory differs from representation in recent popular books and, especially, from its portrayal by critics—often, though not exclusively, conservative Republicans..*

In the above excerpt, we can see that though a certain end of the political spectrum is a vocal critic of CRT, the criticism is not exclusive to them. Hence, Option D can be inferred to be true.



3. Which of the following is equivalent to the type of discrimination mentioned in the third paragraph and highlighted by the example of Kendi's book?

- A. A couple, belonging to a certain race, was misidentified as the perpetrators of a nearby crime.
- B. A medical college provides monetary help to the destitute people of a particular community.
- C. In a law examination, an additional test was added for the people belonging to affluent families.
- D. White people are not treated well when they visit a certain town where only people of colour reside.

Sol. *Some critics claim that the theory advocates discriminating against white people in order to achieve equity. They mainly aim those accusations at theorists who advocate for policies that explicitly take race into account. (The writer Ibram X. Kendi, whose recent popular book *How to Be An Antiracist* suggests that discrimination that creates equity can be considered anti-racist, is often cited in this context.)*

The above excerpt from the passage explains the nature of discrimination which is mentioned in Kendi's book. This refers to discrimination against white people to achieve equity, which means a policy that handicaps them in a certain parameter and levels the playing field.

- A: This option comes under the normal definition of racism. Thus, not the correct answer.
- B: This comes under a general step against racism. Thus, not the correct answer either.
- C: In this example, a handicap is being given to a particular community to level the playing field. Hence, Option C is analogous to the example.
- D: Option D comes close, but is an example of discrimination with no value. It does not achieve equity as it has no benefit for the marginalised race. It only degrades the experience of the white people visiting. Hence, Option D is not an apt answer.

4. Which of the following best captures the central idea of the first two paragraphs?

- A. There is a significant mismatch between the current narratives and the academic understanding of CRT - as evident from the mainstream depictions in books and by its critics.
- B. CRT promotes the idea that race is a social construct and racism is a product of both individual prejudice and the bias entrenched in legal and social institutions.
- C. The presence of facially race-blind policies has made CRT a focus point in popular discourse; however, confusion regarding its meaning and implications persists.
- D. Critics feel that CRT's undue focus on institutional racism leads to negative dynamics with excess emphasis on group identity, which in turn fosters intolerance and divisiveness.

Sol. *"...Critical race theory is an academic concept...And its ideas have since informed other fields, like the humanities, the social sciences, and teacher education. **This academic understanding of critical race theory differs from representation in recent popular books and, especially, from its portrayal by critics**—often, though not exclusively, conservative Republicans. Critics charge that the theory leads to negative dynamics..."*

The first paragraph constitutes a brief discussion of the academic concept of CRT, followed by an illustration to supplement the same. This is followed by a discussion on how the portrayal



of CRT in the mainstream differs largely from its academic understanding. Thus, the key takeaway: there is a significant mismatch between the current narratives and the academic understanding of CRT - as evident from the mainstream depictions in books and by its critics. Option A is the correct choice.

While the definition of CRT is presented in the first paragraph, it is juxtaposed with the mainstream narrative to showcase a different representation of the theory. Option B merely outlines the definition presented in the first paragraph without capturing the overarching message.

The author has not implied or stated that "the presence of facially race-blind policies has made CRT a focus point in popular discourse"; this distortion helps us eliminate Option C.

Option D discounts the elements discussed in the first paragraph and is limited to the points stated in the latter half of the second paragraph.

Hence, Option A is the correct choice.

Instructions

The passage below is accompanied by a set of questions. Choose the best answer to each question.

The Biden administration and Congress have recently made a series of commitments to support industries that are of high strategic importance. The Inflation Reduction Act and Chips and Science Act provide much-needed resources to bolster advances in green energy and increase our domestic supply of semiconductors - two critical long-term priorities.

Yet, there's another significant challenge facing our innovation economy, one that often goes under reported. Abusive patent lawsuits against some of our most innovative companies are on the rise, forcing more and more successful businesses to delay hiring new workers, raising wages, and developing new products. Instead, they're forced to spend money defending themselves against meritless accusations.

The wealthy investors who file these abusive lawsuits, and are often referred to as "patent trolls," buy up portfolios of broad, unused patents that, in many cases, the U.S. Patent & Trademark Office (USPTO) never should have issued in the first place. They then assert the low-quality patents in lawsuits to accuse others of patent infringement - all this even though the patents being asserted will continue to go unused.

The impact on American innovation is devastating. According to one study, each year, patent trolls create \$29 billion in direct, out-of-pocket costs from the companies they go after. Another study found that the companies that settle with patent trolls, or lose to them in court, wind up reducing investments in research and development by an average of more than \$160 million over the next two years. Massive amounts of money are being drained from the hardworking people who are driving our economy forward to instead line the pockets of wealthy investors who are offering no goods or services of their own.

The problem is especially threatening for progress in areas like the renewable energy sector, an industry where products often rely on hundreds or even thousands of underlying patents. U.S. leadership in green technology is critical both to curb emissions and because renewable energy has the potential to be a hub of innovation and strategic advantage for decades to come.

The USPTO recognizes the sector's importance, and its climate change mitigation program will foster research and development in this area. Yet, automakers and other companies generating



cutting-edge technology in this sector are constantly forced into battles with patent trolls that drain resources and delay innovation. Letting patent trolls slow down green-energy advancements would be a colossal mistake.

Critics say that the problem of patent trolling is an invention of large corporations, and that cracking down on patent trolls will mean hurting “the little guy.” These assertions are not backed up by the data: analysis has shown that almost 60% of the companies sued by patent trolls are small or medium-sized; patent-troll litigation costs smaller companies more relative to their revenue; and when infringement claims are settled out of court, smaller companies again pay patent trolls more relative to their revenue.

It is past time for Washington to fix this broken part of our patent system and ensure innovators and entrepreneurs have the tools they need not just to get by, but to get ahead[...]We must also improve transparency in the patent system so that the public knows who the true owners of patents are and patent trolls are prevented from misrepresenting their identities.

5. Through the passage, the author is trying to

- A. explain how patent trolls exploit the existing loopholes in the US patent system to file patent lawsuits that end up thwarting innovators and entrepreneurs from contributing to the economy.
- B. highlight the need to revamp the existing US patent system to mitigate the issue of abusive patent lawsuits from patent trolls and consequently create a conducive environment for innovators.
- C. caution readers against the rising problem of patent trolls who drain massive amounts of money from innovative enterprises and consequently pose a major challenge to the growth of the American economy.
- D. show the need for reforms in the US patent system and explain why the recent policies to support the renewable energy sector will be futile if patent trolls are not thwarted.

Sol. The author is making a persuasive case for improving the existing patent system that is misused by patent trolls to reap personal benefits at the cost of the economy. The author begins by emphasising how these trolls pose a major challenge to economic growth - a set of problems are presented to highlight the ramifications of leaving this problem unchecked. Towards the end of the discussion, the author's tone picks up more urgency - he states that it is past time for the government "to fix this broken part of our patent system." Option B comes closest to capturing this message.

The intention is to "highlight a need" for a specific action and not just to "explain" [Option A] or "caution" [Option C]. While both Options A and C are true, they do not echo the author's message that we "must" make amends to the existing system.

Option D is distorted - the author does not imply that the recent policies to support the renewable energy sector "**will be futile**" if patent trolls are not thwarted. Instead, he welcomes them and feels that they might not realise their full potential due to hindrances caused by patent trolls.

Hence, Option B is the correct choice.



6. Which of the following best captures the main point of the penultimate paragraph?

- A. Given that the majority of companies targeted by patent trolls are small or mid-sized, critics on the subject are wrong in believing that the issue is limited to large organisations.
- B. Patent trolls primarily target small or mid-sized corporations, who often end up fishing out substantial amounts relative to their revenue to settle lawsuits.
- C. The financial detriment caused to small or mid-sized firms by patent trolls is more severe than large corporations that generally can afford settlements given their sizeable revenues.
- D. Crackdown on patent trolls is often viewed as a tyranny of large corporations on individuals or smaller entities by critics.

Sol. {...*Critics say that the problem of patent trolling is an invention of large corporations, and that cracking down on patent trolls will mean hurting “the little guy.” These assertions are not backed up by the data: analysis has shown that almost 60% of the companies sued by patent trolls are small or medium-sized; patent-troll litigation costs smaller companies more relative to their revenue; and when infringement claims are settled out of court, smaller companies again pay patent trolls more relative to their revenue...*} }

The author states that most critics tie the issue of patent trolls to large corporations; however, this is not the case. The author highlights how the critics are wrong by presenting data showcasing how small and mid-sized organisations are more affected. Option A aptly presents this message.

The remaining choices, while partly correct, do not highlight how the critics are mistaken in their beliefs and, thus, can be eliminated.

Hence, Option A is the correct choice.

7. All of the following are repercussions of allowing patent trolls to run free EXCEPT:

- A. Delay in product development and hiring has continued to afflict firms defending themselves against patent trolls.
- B. Firms dealing with infringement lawsuits have witnessed reduced investments in research and development.
- C. Certain sectors might observe delayed innovation and a drain in resources as a result of patent trolls.
- D. The patents that constitute most patent trolls' portfolios continue to go unused.

Sol. Option A: This is true based on the following excerpt - {...*forcing more and more successful businesses to **delay hiring new workers, raising wages, and developing new products**. Instead, they're forced to spend money defending themselves against meritless accusations...*} }

Option B: This can be inferred from the following - {...*Another study found that the companies that settle with patent trolls, or lose to them in court, wind up **reducing investments in research and development** by an average of more than \$160 million over the next two years...*} }



Option C: This can be understood from the following excerpt - {*...The problem is especially threatening for **progress in areas like the renewable energy sector...Yet, automakers and other companies generating cutting-edge technology in this sector are constantly forced into battles with patent trolls that **drain resources and delay innovation...*****}

Option D: The author does not present this point as a repercussion. Rather, this point is presented to highlight the methodology used by patent trolls - {*...buy up portfolios of broad, unused patents that, in many cases, the U.S. Patent & Trademark Office (USPTO) never should have issued in the first place. They then assert the low-quality patents in lawsuits to accuse others of patent infringement - all this even though the patents being asserted will continue to go unused...*}

Hence, Option D is the correct choice.

8. Based on the overall discussion, the reason behind mentioning actions by the Biden administration in the first paragraph could be

- A. to assert that though the government has taken steps in the right direction, it can spur innovation and economic growth only by mending the existing patent system.
- B. to imply that government inaction regarding abusive patent lawsuits would render any commitments benefitting the innovative economy ineffective.
- C. to emphasise that though recent government commitments address some critical long-term priorities, they might not progress smoothly due to the hindrances caused by patent trolls.
- D. to indicate that the government should first deal with the issue of patent trolls and then flag off projects that support industries of high strategic importance.

Sol. The author is making a persuasive case for improving the existing patent system that is misused by patent trolls to reap personal benefits at the cost of the economy. [He highlights the need to mitigate the issue of abusive patent lawsuits from patent trolls and consequently create a conducive environment for innovators.]

Using this message as the lens, the first paragraph indicates that while certain steps to spur growth have been taken, these might not necessarily produce the maximum benefit due to certain barricades - and one such specific hindrance has been mentioned: patent trolls.

Note the second para: {*Yet, there's **another significant challenge facing our innovation economy, one that often goes under reported.***} The author also states: {*Letting patent trolls slow down green-energy advancements would be a colossal mistake.*} Thus, he claims that patent trolls would impede green-energy advancements, and consequently, the innovative economy cannot realize its full potential if the issue of patent trolls persists. Option C comes closest to presenting this idea.

Option A: The author does not claim that the administration can spur economic growth **only** by mending the existing patent system.

Option B: The statement here is distorted - it is not implied that government inaction regarding patent trolls would render commitments **ineffective**.

Option D: No such prescription is presented; we are not informed of the priority order. [The issue of patent trolls is as impelling as any other.]

Hence, Option C is the correct choice.



Instructions

The passage below is accompanied by a set of questions. Choose the best answer to each question.

In his book *Beyond Freedom and Dignity* (1971), psychologist B. F. Skinner wrote that “no theory changes what it is a theory about. Man remains what he has always been.” This is certainly true with respect to our knowledge of the physical world. Before Copernicus, Galileo and Kepler, although many serious thinkers believed the Ptolemaic model of a geocentric universe, their error did not alter the astrodynamics of the solar system, which was then and has continued to be heliocentric, regardless of what theories people have had about it. Similarly for gravity before and after Newton, space-time before and after Einstein, and so forth.

Strictly speaking, the same applies to theories of human nature too: peoples’ instincts, including the ostensible ‘instinct’ for violence, will remain whatever they are regardless of what we think about them. But concerning such matters the connection between expectation and reality becomes complex, because of the risk that theories of human nature feed directly into people being liable to modify their behavior (although not their ‘nature’) as a result. Consider for instance militarists in country A, who are convinced that inhabitants of country B are caught in the grip of an unshakeable instinct-driven war proneness. As a result, A refuses to engage in serious negotiations, preferring to arm itself. Observing A’s actions, and equally convinced that A is inhabited by people with an irrevocable proclivity for war, the leaders of B do the same. Each side points to the other as justifying its own bellicosity, at the same time confirming their often unspoken assumption that war is both natural and inevitable. The danger, in short, of assuming that *Homo sapiens* has a natural instinct for war is that it can become a highly destructive self-fulfilling prophecy, not only closing off possible avenues of peaceful conflict resolution, but actually making war more likely.

Nonetheless, a purportedly scientific view of anything - humanity’s presumed instinct for warfare included - must stand or fall not on its social and political consequences but on its scientific credentials. And here, the ‘war is in our genes’ perspective is not only scientifically invalid but ethically suspect. The late Carl Sagan famously pointed out that extraordinary claims require extraordinary evidence. I believe that we should extend this dictum to say that claims with potentially destructive social consequences also require extraordinary evidence. This makes it especially regrettable that a substantial current of recent academic writing - much of it given the apparent imprimatur of evolutionary science - has suggested that *Homo sapiens* is inherently violent and warlike. Last year, for example, an article in *The National Interest* entitled ‘What Our Primate Relatives Say About War’ answered the question ‘Why war?’ with ‘Because we are human’. At about the same time, a piece in *New Scientist* asserted that warfare has “played an integral part in our evolution,” and a research report in the journal *Science* claimed that “death in warfare is so common in hunter-gatherer societies that it was an important evolutionary pressure on early *Homo sapiens*.”

Most influential has been the research of anthropologist Napoleon Chagnon, whose decades-long study of the ‘fierce’ Yanomamo people of the Amazon rainforest has been widely interpreted as proving that if you scratch the superficial surface of civilization, human beings will be revealed to be natural born killers [...] Many biologists and more than a few social scientists have extrapolated from the Yanomamo to *Homo sapiens* generally, arguing that what holds for the former is therefore true for the latter as well.



9. Which of the following statements contradicts Skinner's statement mentioned in the first paragraph?

- A. A theory can deal with a plethora of subjects that are beyond human comprehension.
- B. Popular theories in circulation make people conform to the predicted character traits.
- C. There is still widespread debate over whether the universe is heliocentric or not.
- D. The character traits of a person change with time and experience.

Sol. "no theory changes what it is a theory about. Man remains what he has always been".

The statement implies that a theory cannot alter the subject it deals with. This means that if a theory is changed, it does not mean that there would be an alteration to the subject itself, thus, the characteristics of the subject are independent of the theories on it.

To contradict this, we need a statement that implies a causation between the two i.e. a theory that produces a change in its subject.

- A: This does not imply that there is a causation.
- B: This implies a strong causal link between the theory of behaviour and the behaviour observed consequently. If theories change, people change their behaviour accordingly. Option B is the correct answer.
- C: The statement has nothing to do with the scientific fact the author mentions to explain the statement.
- D: The statement does not imply that a man does not change, but that a man does not change due to a change in theory.

10. Using the examples of the articles in The National Interest and New Scientist, the author intends to

- A. undermine the credibility of recent scientific endeavours that draw from evolutionary science to prove the inherently violent and warlike nature of humans.
- B. showcase the fallacy in using evolutionary science to back claims on the innately violent nature of humans.
- C. express his dismay concerning scientific pieces that assert the inherently warlike nature of humans without providing substantial evidence.
- D. showcase how most academic writings do not address the critical questions regarding the innately violent nature of humans and instead treat the subject superficially.

Sol. {...The late Carl Sagan famously pointed out that **extraordinary claims require extraordinary evidence**. I believe that we should extend this dictum to say that **claims with potentially destructive social consequences also require extraordinary evidence**. This makes it **especially regrettable** that a substantial current of recent academic writing - much of it given the apparent imprimatur of evolutionary science - has suggested that Homo sapiens is inherently violent and warlike...}

The author laments how scientific articles make claims concerning the violent nature of humans without presenting sufficient evidence. The example of The National Interest particularly



highlights this: the author emphasises the mismatch between the question and the answer [‘Why war?’ is answered with ‘Because we are human’]. Thus, these articles appear to employ circular reasoning instead of presenting concrete proof showcasing the inherently violent tendencies of humans. Option C comes closest to capturing this point.

Options A and B are neither stated nor implied. Additionally, the author does not claim that the subject is treated superficially; instead, his issue is with the form of evidence provided. Hence, Option D is also incorrect.

Hence, Option C is the correct choice.

11. Which of the following best captures the overarching idea presented by the illustration involving militarists in countries A and B?

A. Theories that mould perceptions regarding human nature could influence people to alter their behaviour, leading to potentially adverse outcomes in some instances.

B. The belief that humans are naturally predisposed to war can become a highly destructive self-fulfilling prophecy, causing most conflicts to manifest.

C. Wars break out due to the mistaken belief regarding the enemy’s innate proclivity for war and can be averted if such theories are not promoted.

D. Justification of conflict by placing the onus on the enemy further perpetuates the idea involving the violent and warlike nature of humans.

Sol. Before presenting the illustration, the author mentions the following idea: {*...But concerning such matters the connection between expectation and reality becomes complex, because of the risk that theories of human nature **feed directly** into people being **liable to modify their behavior** (although not their ‘nature’) as a result...*}

After the illustration, the following caution is presented: {*...The **danger**, in short, of assuming that Homo sapiens has a natural instinct for war is that it can become a highly destructive self-fulfilling prophecy, not only closing off possible avenues of peaceful conflict resolution, but actually **making war more likely**...*}

The author highlights that theories on human nature could potentially cause a person to 'modify' their behaviour. An example is then presented where militarists from two nations - A and B - engage in conflict due to their perceptions of the enemy's innate 'warlike nature'. The author then cautions that, more often than not, such perceptions (that are moulded or fuelled by common theories) could have adverse outcomes. The overarching idea: theories that mould perceptions regarding human nature could influence people to alter their behaviour, leading to potentially adverse outcomes in some instances. Option A correctly captures this.

Option B: While true based on the discussion, it fails to capture the broader picture and merely emphasises the outcome. The author intends to highlight how theories could impact behaviour, which in turn could lead to catastrophic events.

Options C and D: The points presented here are neither stated nor implied. The author does not suggest that "[wars] can be averted if such theories are not promoted." Similarly, there is no information to back up the claim that "Justification of conflict...perpetuates the idea..." Therefore, we can reject these choices.

Hence, Option A is the correct choice.



12. All of the following would help the author rebuke the claim by biologists and social scientists in the final paragraph EXCEPT:

- A. Extrapolating the traits of Yanomamo to *Homo sapiens* is akin to seeing a white polar bear and concluding that all bears have white fur.
- B. While the Yanomamo are indeed quite violent, many other culturally similar communities are not, including the Batek of Malaysia, the Hadza of Tanzania, and a half-dozen or more indigenous African forager societies.
- C. The example of the Yanomamo to 'prove' our inherent warlikeness is based on the premise that one group is somehow more indicative of a 'natural human condition' than the other.
- D. Studies by various anthropologists have yielded divergent observations on the degree of violence showcased by the Yanomamo and thus, have made it challenging to definitively quantify the warlikeness of this group.

Sol. Claim: {...*'fierce' Yanomamo people of the Amazon rainforest has been widely interpreted as proving that if you scratch the superficial surface of civilization, human beings will be revealed to be natural born killers [...]* Many biologists and more than a few social scientists have *extrapolated from the Yanomamo to Homo sapiens generally, arguing that what holds for the former is therefore true for the latter as well...*}

Option A: {**Extrapolating the traits of Yanomamo to *Homo sapiens* is akin to seeing a white polar bear and concluding that all bears have white fur.**}

If true, this would underline the logical fallacy of the claim. We come across an error of composition wherein the claimant attributes the characteristics of an individual entity within a group to the entirety of this group or to other entities within this group. Just because one group has a violent nature does not naturally make the entire humankind violent.

Option B: {**While the Yanomamo are indeed quite violent, many other culturally similar communities are not, including the Batek of Malaysia, the Hadza of Tanzania, and a half-dozen or more indigenous South American forager societies.**}

If true, this argument builds on the idea in Option A. The Yanomamo are not representative of all of humanity - other similar communities/groups show divergent behaviour. Therefore, if the Yanomamo 'prove' that humans are inherently violent, then the presence of other groups should naturally disprove this claim.

Option C: {**The example of the Yanomamo to 'prove' our inherent warlikeness is based on the premise that one group is somehow more indicative of a 'natural human condition' than the other.**}

Option C supports the point in Option B. We are ascribing weightage to one group's humanness when using them as a reference to indicate the natural human condition. Does this mean that other groups which were excluded do not truly represent humans? Or that the Yanomamo are 'more human' than other groups, which is why we are using their examples as being indicative of the warlike human nature? Hence, Option C highlights the flaw in the claim presented in the final paragraph.

Option D: {**Studies by various anthropologists have yielded divergent observations on the degree of violence showcased by the Yanomamo and, thus, have made it challenging to definitively quantify the warlikeness of this group.**}



The statement here does not rebuke the claim since it moves forward with the belief that the Yanomamo are violent; the only disagreement is with regard to 'how violent?'.
Hence, Option D is the correct choice.

Instructions

The passage below is accompanied by a set of questions. Choose the best answer to each question.

Humans are not the only creatures that show a refined grasp of social norms. If a group of adult male rhesus monkeys find themselves sitting around a turning table set with food, they will display an 'I scratch your back, you scratch mine' ethos of reciprocity. One monkey will offer another one a piece of fruit and, what's more, will expect the gesture to be reciprocated.

[...]While decades of research have dispelled the myth that sociality is unique to our species, scientists are still unclear about just how individual animals retain information about the structure of the 'society' in which they're embedded. Are the monkeys simply copying each other and sharing food via a sophisticated form of mirroring? Or are they truly keeping track of their own and others' behaviour in order to make decisions within a broader social dynamic?

[...]Following the emergence of the modern discipline of ethology - the study of animal behaviour - we've been left with two main ways of framing enquiries into the social lives of animals. One approach takes data from observations of animals in the field, trying to understand the group dynamic by looking from the 'outside in'. Yet this necessarily makes it hard to fathom what's happening inside an individual creature's mind. By contrast, the second approach is based on detecting an individual's brain activity, and then on trying to draw a map between patterns of neuronal spiking or firing - the oscillating electrical activity that produces brain waves - and how the animal acts. Yet this data comes from the 'inside out', and often struggles to encompass group dynamics. Both of these frames tend to capture an incomplete picture.

Now a new generation of scientists is pushing for a third, more nuanced paradigm for studying animal sociality. Known as 'collective neuroscience', this research programme proceeds from the idea that brains have evolved primarily to help animals exist as part of a social group - rather than to solve problems per se - and should be studied as such. Since embedding a brain within a social structure changes how it and other brains perform, it makes no sense to only study individual minds in isolation, because it doesn't provide the full picture. Based on the notion that intelligence is a dynamic of looping cause and effect among multiple brains, researchers are drawing on the latest neuroimaging techniques to try to obtain a more detailed understanding of multiple animals' brain states as they engage in a variety of social activities.

[...] Much research in cognitive science examines how one brain responds to basic stimuli - such as how we work through a problem a friend is recounting, or how we remember that same conversation weeks later. But even a study looking at the dynamic between two individuals lacks certain aspects of the diversity of interactions that emerge naturally in organic, more complex social groups - including attention allocation, creating subgroups, and recruiting allies.



13. Which of the following best represents the ‘outside-in’ and ‘inside-out’ modes of enquiries and their corresponding limitations [in that order]?

- A. external - no information on individual behaviour; internal - no information on group behaviour
- B. field observations - difficulty understanding individual actions; mapping individual brain activity - disregards group dynamics
- C. external observations - superficial insights; map patterns of neuronal spiking - invasive
- D. observes individual actions - group behaviour not considered; observes group dynamics - individual behaviour not considered

Sol. Outside-in: {One approach takes data from **observations of animals in the field**, trying to understand the group dynamic by looking from the ‘outside in’. Yet this necessarily makes it **hard to fathom what’s happening inside an individual creature’s mind.**}

Inside-out: {By contrast, the second approach is based on detecting an **individual’s brain activity**, and then on trying to draw a map between patterns of neuronal spiking or firing - the oscillating electrical activity that produces brain waves - and **how the animal acts**. Yet this data comes from the ‘inside out’, and often **struggles to encompass group dynamics.**}

In Option A, the terms "external" and "internal" are vague and do not appropriately give clues about the two modes of enquiries. Furthermore, the phrasing "no information..." is a bit extreme. The author talks about the challenge while describing the limitations.

Option B correctly captures the keywords. The phrase 'field observation' corresponds to the outside-in mode of enquiry, and the 'difficulty [in] understanding individual actions' is the stated disadvantage. Similarly, the inside-out mode of inquiry involves 'mapping individual brain activity' but 'disregards group dynamics' [limitation]

Option C is incorrect since there is no reference to 'superficial insights' or the inside-out mode being 'invasive'.

The description in Option D does not correspond to the ‘outside-in’ and ‘inside-out’ modes of enquiries [in that order] as presented in the question.

Hence, Option B is the correct choice.

14. The example in the first paragraph

- A. illustrates that while sociality is not unique to humans, the underlying mechanisms governing such group dynamics in animals remain obscure.
- B. demonstrates how the ethos of reciprocity is not limited to humans, indicating that individual animals understand the structure of the society in which they’re embedded.
- C. showcases that the reciprocal behaviour observed in certain animal groups indicates that they have a refined understanding of social norms akin to humans.
- D. portrays that though animals showcase a refined grasp of social norms, it is difficult to pinpoint the factors influencing such behaviour using existing methodologies.

Sol. The author opens the discussion with the following claim: {Humans are **not the only creatures that show a refined grasp of social norms.**} This point is re-iterated - albeit in a



modified way - in the second paragraph: *{While decades of research have **dispelled the myth that sociality is unique to our species, scientists are still unclear** about just how individual animals retain information about the structure of the ‘society’ in which they’re embedded.}* The example is sandwiched between these two excerpts (and invoked in the latter half of the second paragraph), enabling us to identify the author's intent. The key message is that sociality is not unique to humans - animals also exhibit this trait; however, our understanding of this phenomenon in animals is limited. Option A correctly captures this point.

Option B, while true, misses out on how scientists have little to no understanding of how this phenomenon plays out in animals. Similarly, Option C focuses on a tangential element.

Option D contains a distortion: there is no mention of "existing methodologies".

Hence, Option A is the correct choice.

15. How does collective neuroscience circumvent the limitations associated with the existing modes of enquiries?

A. It offers a more nuanced paradigm for studying animal sociality by drawing on the latest neuroimaging techniques to understand multiple animals’ brain states concurrently.

B. It renders a more complete picture of sociality by building on the idea that animal brains have evolved primarily to help them thrive in social groups rather than to solve problems.

C. It accounts for the intertwined interactions among multiple brains and draws insights by mapping brain states during social interplay, thereby presenting a more holistic picture.

D. It points out that studying individual minds in isolation is counterintuitive since embedding a brain within a social structure changes how it and other brains perform.

Sol. We are informed of the limitations associated with the two existing modes of enquiry - both modes do not paint a complete picture:

1. the inside-out mode focuses on information on the individual but misses out on capturing group dynamics.

2. the outside-in mode examines the group dynamics but misses out on the information on the individual.

Collective neuroscience circumvents these issues by focusing on both individuals and the group. Individual brain activity is mapped simultaneously while observing complex social interplay. The author states: *{...Based on the notion that intelligence is a dynamic of looping cause and effect among multiple brains, researchers are drawing on the latest neuroimaging techniques to try to **obtain a more detailed understanding of multiple animals’ brain states as they engage in a variety of social activities...**}* We notice that collective neuroscience overcomes the limitations of both modes of enquiry by accounting for the intertwined interactions among multiple brains and drawing insights by mapping brain states during social interplay, thereby presenting a more holistic picture. Option C correctly captures this.

Options A, B and D are true - however, they do not convey **how** collective neuroscience circumvented the limitations of the other two modes of enquiry.



16. The author distinguishes cognitive science from collective neuroscience in that

- A. the latter looks at the dynamic between two individuals as opposed to the focus of the former on a single individual's behaviour.
- B. the latter focuses on complex interactions such as attention allocation, creating subgroups, and recruiting allies apart from basic stimuli.
- C. the latter makes room for other dynamic elements than brain responses to basic stimuli while studying interactions.
- D. the latter inspects a more diverse range of interactions that originate out of complex social dynamics.

Sol. The author states the following towards the end of the discussion: *{Much research in cognitive science examines how one brain responds to basic stimuli - such as how we work through a problem a friend is recounting, or how we remember that same conversation weeks later. But even a study looking at the dynamic between two individuals lacks certain aspects of the diversity of interactions that emerge naturally in organic, more complex social groups - including attention allocation, creating subgroups, and recruiting allies.}*

We understand that collective neuroscience accounts for the complex social interplay - it is hinted that a diverse range of interactions that originate in such setups is studied as opposed to a single brain (cognitive science). Hence, the focus is on the range of interactions that are examined. This is aptly captured in Option D.

Option A: The author clarifies that even an interplay between two individuals might not produce the range of interactions that organically stem from complex social dynamics. Furthermore, the focus here is on the number of individuals studied instead of the kind of interactions. Hence, Option A can be eliminated.

Option B: While true, the statement fails to capture the broader idea. Those examining interactions from the lens of collective neuroscience need not limit themselves to just attention allocation, creating subgroups, and recruiting allies. There could be a set of other patterns that have been omitted.

Option C is not implied in the passage and, thus, can be rejected.

Hence, Option D is the correct choice.

17. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

In contrast with her male contemporaries, who derided the very idea of women's 'vocation' and argued that women do not possess the acumen for intellectual achievement, Holst focused on women's vocation and the relation between education and vocation. In her *On the Vocation of Women to Higher Intellectual Development* (1802), Holst argues, first, that women should not be excluded from seeking to achieve their vocation on account of sexual 'duties' (as some male philosophers sought to demonstrate); and, second, that women's perspective on social relations sheds unique light on the power dynamic between men and women. It reveals the extent to which women's place within society is determined not by enlightenment, or reason, but by these power relations.



A. Holst advocated for women's vocation by claiming that sexual duties shouldn't prevent the pursuit of vocation and revealing how the power dynamic between men and women determines the latter's position in society.

B. In her book, Holst revealed that the skewed power dynamic between men and women - instead of reason or enlightenment - is responsible for women being unable to pursue their vocation.

C. Unlike her male contemporaries, Holst argued that barring women from pursuing their vocation on the grounds of sexual duties reflected how the existing power dynamic determined women's position in society.

D. Holst rubbished the arguments of her male contemporaries by showing that women possess the acumen to pursue their vocation and should not be held back on account of the existing power dynamics or their sexual duties.

Sol. The main points of the passage are:

1. Holst advocated for women's vocation by arguing that women should not be excluded from seeking to achieve their vocation on account of sexual 'duties'
2. She also showed how women's place in society is not determined by their talent but by the power dynamic between men and women.

Option A comes the closest to capturing this and is the correct answer.

Option B misses out on point 1.

Option C is distorted. The two points are presented as independent elements, and no explicit relationship between them is established. It is not implied that point 1 "reflects" point 2.

Option D is distorted. There is no mention of Holst "showing" that women possess the acumen for intellectual achievement.

18. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.

1. The first explosions rang out after 1 a.m., shattering the calm in the neighbourhood that was home to President Jovenel Moïse and many of Haiti's most affluent citizens.
2. By dawn, a much different reality had emerged: The president was dead.
3. A group of assailants had stormed Mr Moïse's residence in what officials called a well-planned operation that included "foreigners" who spoke Spanish.
4. Residents immediately feared two of the terrors that have plagued the nation — gang violence or an earthquake.

Sol. A brief reading of the sentences suggests that the paragraph is about the assassination of Haiti's president. 1 sets the backdrop of the event by mentioning the time and location of the event. As it mentions the President's full name it should come before other sentences where he is referred to by his last name. 4 then mentions the potential reasons the residents thought of that could have caused the noise. 2 then presents the real cause, which was the assassination of the president. 3 then further delves into the details about the perpetrators of the assassination. Hence, the correct sequence is 1423.



19. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.

1. But we still haven't thought enough about how to handle all accusations with proportion and fairness. And we haven't thought much at all about what to do when we're wrong.
2. Employers have an obligation to protect and respect *all* employees, which means both parties to an accusation.
3. We've thought a lot, as a country, about what to do with the men who are guilty of sexual violence and harassment.
4. Hollywood and other industries long blinded themselves to their wrongdoers, and they now risk refusing to consider anything other than abject guilt.

Sol. A brief reading of the sentences suggests that the paragraph is about what to do when the allegations of sexual misconduct against someone are wrong. 3 is an apt opening to the paragraph, which highlights what the status quo is. A lot of thought has been put into deciding what should be done about the guilty. 1 then presents the other side of the coin, where we have not thought much about what to do when the person turns out to be innocent. 4 then talks about how earlier industries turned a blind eye to wrongdoing. Now, in a 180-degree turn, it is assumed that it took place. 2 then ends the paragraph by saying that there is a moral obligation that we respect both sides of the accusation.

Hence, the correct sequence is 3142

20. Five sentences related to a topic are given below. Four of them can be put together to form a meaningful and coherent short paragraph. Identify the odd one out.

1. Over the years, we've heard of dogs saving people from muggings, fires and bear attacks, and even alerting new parents to very ill babies.
2. Old-fashioned dog behaviourism has said not, pointing to the fact that they can be rehomed and recover almost immediately.
3. They have empathy, they can laugh, and make one another laugh (their play-panting, when analysed on a sonograph, corresponds to decreased stress levels and institutes play in other dogs).
4. Do our dogs love us? As in, do they love us the way we love them?
5. More recent research, however, from evolutionary psychologists Brian Hare and Vanessa Woods, particularly (in *The Genius of Dogs* and *Survival of the Friendliest*), shows that dogs respond positively to positive emotions.

Sol. A brief reading of the sentences suggests that the paragraph discusses the question that whether our dogs love us. 4 is the introduction to the question that sets the context for the paragraph. 2 replies in negative, that they do not. 5 then presents a counterpoint using recent research. 3 is a direct continuation of 5.

1 talks about a different aspect of dogs, where they help humans in certain ways. This is unrelated to the discussion about dogs having feelings. Hence, 1 is out of context here.



21. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

I find the phrase “getting your body back” so fascinating, and so telling. It’s a very common phrase — if you google it you find thousands of websites offering advice on how women can change their bodies after giving birth. What’s so interesting is that the phrase isn’t something like “getting slimmer after pregnancy” but rather “getting your body *back*”, which implies that the body you find yourself with after birth is not really *yours*. It’s some sort of counterfeit, imposter body, contrasted with the supposedly real, authentic body that you had before you were pregnant.

- A. Getting slimmer after pregnancy is equated to getting one's body back, inviting a farrago of remarks about body shaming.
- B. The phrase 'getting your body back' is fascinating as it implies that a woman's body after pregnancy is not her own, real body.
- C. The phrases used to define a person undergoing a radical body transformation should avoid referring to the body as imperfect.
- D. After the body's radical transformation during pregnancy, women receive harsh remarks that lead them to view their bodies as that of an impostor.

Sol. The main point of the paragraph is that the phrase about getting one's body back after pregnancy is quite fascinating as it implies the false notion that the body that a woman has after pregnancy is not really hers and it could be somehow reverted back to hers. Option B comes the closest to capturing this, and hence, is the correct answer.

- A: Misses out on the implication of the phrase.
- C: The author does not advocate anything in the paragraph, he merely states it.
- D: Option D distorts what is given in the passage by implying that women feel their bodies are not their own.

22. Five sentences related to a topic are given below. Four of them can be put together to form a meaningful and coherent short paragraph. Identify the odd one out.

1. My grandmother did know that Boris had been a member of the Arājs Kommando, a Latvian auxiliary police unit formed by the Nazis, which became known as one of the most brutal killing brigades of the second world war.
2. What remains is an image barely more than an inch wide, just large enough to capture my grandfather’s face in profile. His hair is slicked back, his eyes squint into the sun, and his lips are pursed.
3. The photograph was probably taken not long before my grandfather disappeared. The edge is uneven. Someone, or something, has been clipped from the picture.
4. My father tells me it is one of the few images he has of his father, whose name was Boris.
5. He is seated on the grass in what looks to be someone’s front yard. He cradles a bouquet of wildflowers.



Sol. A brief reading of the sentences suggests that the paragraph is about a person viewing his grandfather's picture shown by his father. 3 opens the paragraph here, mentioning the main subject of the discussion: the photograph. 2 and 5 are a continuation of 3, adding more details about the contents of the picture. 4 then introduces who is the main element in the photograph: Boris.

1 digresses from the topic at hand by skipping much ahead to Boris' work as part of a police unit instead of what the picture portrays. Hence, 1 is out of context here.

23. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.

1. While Judeo-Christian moral values aren't exactly Nietzsche's preference, he sees their sudden removal as dangerous.
2. God was not just an innocuous source of faith and worship, Nietzsche recognizes: God was the indubitable authority that lent power and legitimacy to Judeo-Christian moral values.
3. The appropriate response to the age of Enlightenment leading to the death of God, Nietzsche argues, should not be a jeering celebration, nor a shrug of indifference, but a period of deep disorientation and mourning.
4. Indeed, regardless of its degenerative, life-denying properties, the Judeo-Christian moral system is at least a mechanism for value creation, Nietzsche says.

Sol. A brief reading of the sentences suggests that the paragraph must be about Nietzsche's opinion on the matter of 'Death of God' and consequent demise of the Judeo-Christian moral system. 3 is an apt opening sentence that introduces the event that is triggering Nietzsche's caution and alarm - the Enlightenment leading to the death of the idea of God. 2 extends the idea by saying that it isn't the idea of God alone that is dying but also the Judeo-Christian moral system which derived its legitimacy from God. 1-4 together states that while the moral system isn't to Nietzsche's liking and has many flaws, it still holds value. 4 should come after 1 as the starting word "Indeed ..." indicates that it is adding to a similar point stated earlier - which has to be 1.

Hence, the order of the sentences is 3214.

24. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Some 20,000 years ago in a cave in a cliff wall in the Grand Canyon, two American cheetahs battled tooth against claw. The victor is lost to history, but one of the big cats, a juvenile that was bitten through the spine, likely died where it fell on the cave floor, leaving behind bones and bits of mummified tissue. Now, the remains of this unfortunate feline, along with fossils from two other Grand Canyon caves, have revealed that the extinct American cheetah may not have been swift flatland sprinters like Africa's modern cheetahs. Instead, these cats may have been more like today's snow leopards, prowling cliffsides and rocky regions and eating mostly mountain goats and bighorn sheep.

A. Fossil remains from skirmishes between American cheetahs have provided insights into their early habitats, with evidence indicating that these animals may have been more like modern snow leopards.



B. The remains of an American cheetah from a cave in the Grand Canyon, along with fossils from two other caves, reveal that the Cheetahs more likely inhabited rocky terrains rather than flatlands.

C. Traces of the fight between two American cheetahs 20,000 years ago found in Grand Canyon caves have provided insights into the basic nature of this now-extinct species.

D. American Cheetahs that roamed 20,000 years ago are more similar to today's snow leopards living in rocky terrains than Africa's modern cheetahs that prowl the flatlands, as substantiated by fossils found in caves of the Grand Canyon.

Sol. The main points of the paragraph are:

1. The first half talks about the findings: 20,000-year-old remains of an American cheetah -who died in a fight with another American cheetah - was found. Other fossils were also found in two other Grand Canyon caves.

2. The second half discusses the insights drawn from the findings: The remnants reveal that the species was based in rocky terrains (like today's snow leopards) than flatlands (Africa's modern cheetahs).

Option B comes the closest to capturing the above points and is the correct answer.

Option A misses out on certain critical information. Firstly, the inference regarding "early habitats" is unclear. Furthermore, the comparison is with regard to rocky terrains and flatlands. Contrarily, Option A merely highlights that prehistoric American cheetahs are similar to modern-day snow leopards, which, although true, does not capture the message.

Option C is distorted: what qualifies as "basic nature"? It completely misses out on point 2.

Option D, distorts the level of certainty. The author says that the assertion is 'likely' and not 'substantiated' or confirmed as suggested by option D.

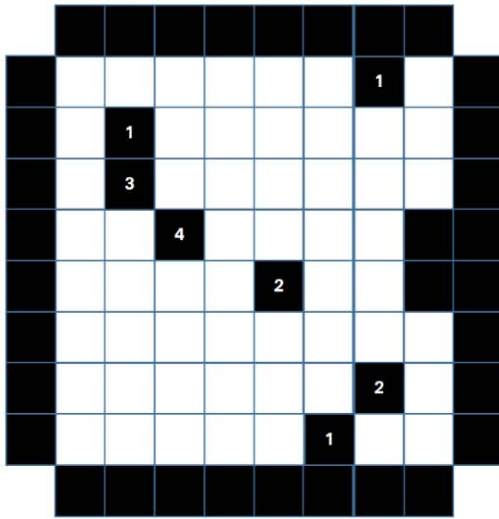
Instructions

Japanese interior designer Satoru Gojo shows two room layouts to one of his clients, as shown below. The room is divided into smaller square grids such that a black-coloured grid represents a wall partition. Multiple lightbulbs must be placed inside the rooms to illuminate them evenly. Gojo gives the task of determining the placement of these bulbs to his client along with the following instructions:

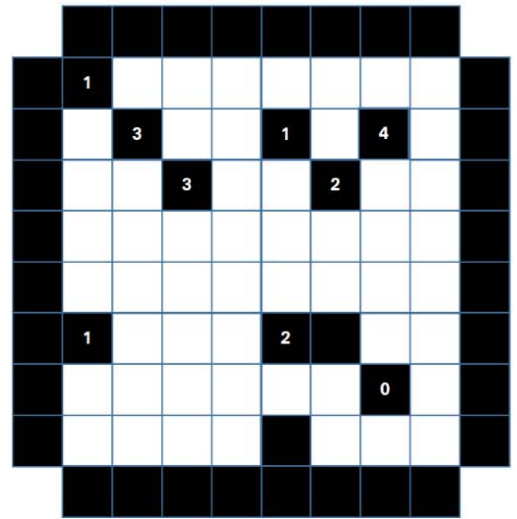
1. The objective is to fully illuminate the room. Lightbulbs send out rays vertically and horizontally that do not pass through the black-coloured partitions. They must be placed on empty/uncoloured grids such that the rays from two lightbulbs can intersect but not coincide.

2. The numbers in the black-coloured grids serve as clues indicating the number of lightbulbs that are orthogonally adjacent to them, which means that it provides information regarding the number of lightbulbs that are adjacent to the grid vertically or horizontally, but not diagonally. Unnumbered black-coloured grids may or may not have lightbulbs adjacent to them.

Layout 1



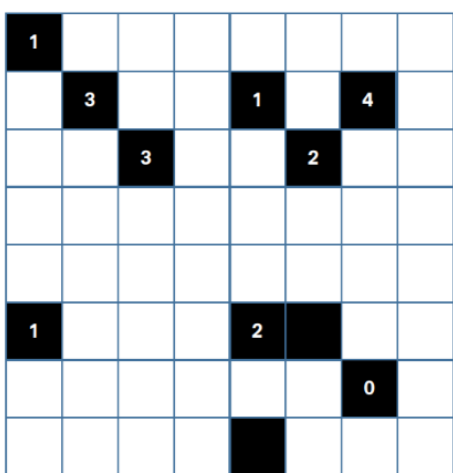
Layout 2



25. How many lightbulbs in Layout 2 are not orthogonally adjacent to a numbered black grid?

- A. 0
- B. 1
- C. 2
- D. 3

Sol.



We can begin by placing the lightbulbs around the numbered grids with values 3 and 4. We notice that a lot of grids get illuminated, as shown below. Notice that there are two possibilities for one of the grids numbered 3. However, placing the lightbulbs around other numbered grids might help zero in on the correct placement.

1						B	
B	3	B	x	1	B	4	B
	B	3		x	2	B	
					x		
1				2		x	
					x	0	x
						x	

It becomes clear that the grid numbered 1 adjacent to the grid with value 3 can have a lightbulb in just one specific spot. Similarly, the other grid numbered 1 (in the same column in the figure), also has just one spot where a lightbulb can be placed, as shown below:

1						B	
B	3	B	x	1	B	4	B
	B	3		x	2	B	
					x		
				B			
1			B	2		x	
B					x	0	x
						x	

Similarly, the remaining grid numbered 2 can also have one possible arrangement, as shown below. This leaves us with one specific arrangement of the lightbulb for grids numbered 3.

1						B	
B	3	B	x	1	B	4	B
	B	3		x	2	B	
		B			x		
				B			
1			B	2		x	
B					x	0	x
					P	x	



In the figure above, we also have an empty grid (marked P) without any light source around. Hence, to fully illuminate the room, a lightbulb needs to be placed in this grid, as shown below:

1						B	
B	3	B		1	B	4	B
	B	3		x	2	B	
		B			x		
				B			
1			B	2		x	
B					x	0	x
					B	x	

One lightbulb in Layout 2 is not orthogonally adjacent to a numbered grid.

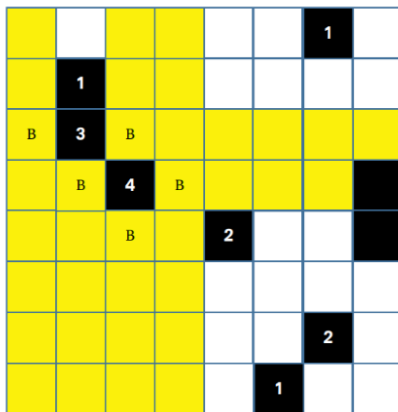
26. What is the total number of lightbulbs needed in Layout 1?

- A. 8
- B. 10
- C. 11
- D. 12

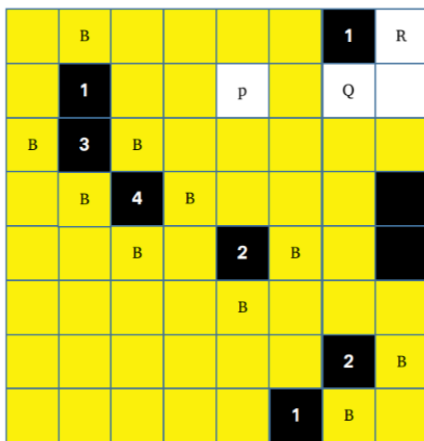
Sol.

						1	
	1						
	3						
		4					
				2			
						2	
					1		

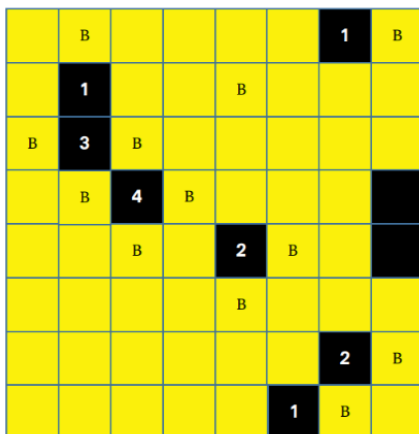
We can begin by placing the lightbulbs around the numbered grids with values 3 and 4. We notice that a lot of grids get illuminated, as shown below:



It becomes clear that the grid numbered 1 adjacent to the grid with value 3 can have a lightbulb in just one specific spot. Similarly, the grids numbered 2 can also have one possible arrangement, as shown below: [the bottom right space in the figure can be filled with two lightbulbs without creating any overlap.]



In the grid numbered 1 (at the top right corner in the figure), there are two possible spaces where the lightbulb can be placed - Q and R. If we place the bulb in grid Q, no light reaches grid R. Contrarily, if we place a lightbulb in grid R, we can place another lightbulb in grid P to illuminate the remaining spaces without any overlap, as shown below:



Hence, the total number of lightbulbs needed in Layout 1 is **12**.

27. What is the total number of lightbulbs needed in Layout 2?

Sol.

1							
	3			1		4	
		3			2		
1				2			
						0	

We can begin by placing the lightbulbs around the numbered grids with values 3 and 4. We notice that a lot of grids get illuminated, as shown below. Notice that there are two possibilities for one of the grids numbered 3. However, placing the lightbulbs around other numbered grids might help zero in on the correct placement.

1						B	
B	3	B	x	1	B	4	B
	B	3		x	2	B	
					x		
1				2		x	
					x	0	x
						x	

It becomes clear that the grid numbered 1 adjacent to the grid with value 3 can have a lightbulb in just one specific spot. Similarly, the other grid numbered 1 (in the same column in the figure), also has just one spot where a lightbulb can be placed, as shown below:

1						B	
B	3	B	x	1	B	4	B
	B	3		x	2	B	
					x		
				B			
1			B	2		x	
B					x	0	x
						x	



Similarly, the remaining grid numbered 2 can also have one possible arrangement, as shown below. This leaves us with one specific arrangement of the lightbulb for grids numbered 3.

1						B	
B	3	B	x	1	B	4	B
	B	3		x	2	B	
		B			x		
				B			
1			B	2		x	
B					x	0	x
					P	x	

In the figure above, we also have an empty grid (marked P) without any light source around. Hence, to fully illuminate the room, a lightbulb needs to be placed in this grid, as shown below:

1						B	
B	3	B		1	B	4	B
	B	3		x	2	B	
		B			x		
				B			
1			B	2		x	
B					x	0	x
					B	x	

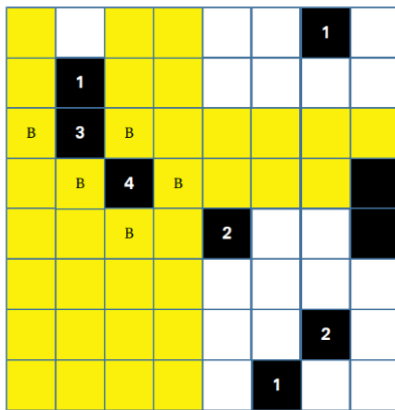
The total number of lightbulbs needed in Layout 2 is 12.

28. In Layout 1, what is the total number of grids illuminated by lightbulbs that are not placed orthogonally adjacent to a numbered grid?

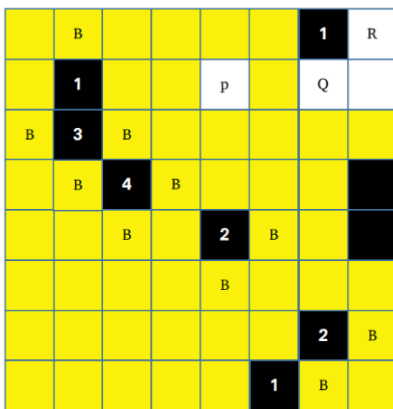
Sol.

						1	
	1						
	3						
		4					
				2			
						2	
						1	

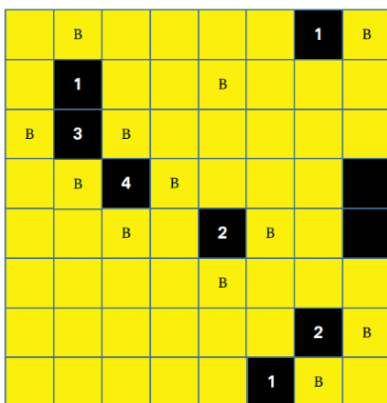
We can begin by placing the lightbulbs around the numbered grids with values 3 and 4. We notice that a lot of grids get illuminated, as shown below:



It becomes clear that the grid numbered 1 adjacent to the grid with value 3 can have a lightbulb in just one specific spot. Similarly, the grids numbered 2 can also have one possible arrangement, as shown below: [the bottom right space in the figure can be filled with two lightbulbs without creating any overlap.]



In the grid numbered 1 (at the top right corner in the figure), there are two possible spaces where the lightbulb can be placed - Q and R. If we place the bulb in grid Q, no light reaches grid R. Contrarily, if we place a lightbulb in grid R, we can place another lightbulb in grid P to illuminate the remaining spaces without any overlap, as shown below:



Hence, the total number of grids illuminated by lightbulbs that are not placed orthogonally adjacent to a numbered grid is 9.



Instructions

There is no constant passcode for a parking lot in Parker’s house. The passcode resets automatically every time after each login. New passcode is shown on the screen using the letters (A-J) and symbols (@, #, \$, !, *, ^, {, }). Each letter and symbol is assigned to a number from 0 to 9. Each letter is assigned a different number, and each symbol is assigned a different number. A letter and a symbol can assign with the same number. Parker’s father doesn’t tell the code of each letter and symbol directly; instead, he gives him a puzzle.

		A	B	C		@	#	\$
		x	D	C	E	x	!	\$
		F	G	F	H		*	#
	I	A	J	C		{	!	}
J	E	A	D					
	D	H	B	D	G	H		
						{	^	{
								#

' × ' indicates multiplication

29. How many factors does the code ‘DI#’ have?

- A. 8
- B. 2
- C. 4
- D. 6

Sol.

I:

Let @ = P, # = Q, \$ = R, ! = S, * = T, { = U, } = V, ^ = W

	P	Q	R
		S	R
	Q	T	Q
U	S	V	
U	W	U	Q

$R * R = Q$

R can take values 2, 3, 4, 7, 8 and 9

Case 1:

$R = 2$

$Q = 4$

$T = 8$



$$\begin{array}{r}
 P \quad 4 \quad 2 \\
 \quad 2 \\
 \hline
 4 \quad 8 \quad 4 \\
 \hline
 \end{array}$$

This implies $P = 2$
 As $R = 2$, this case is not possible

Case 2:
 $R = 3$
 $Q = 9$
 $T = 7$

$$\begin{array}{r}
 P \quad 9 \quad 3 \\
 \quad 3 \\
 \hline
 9 \quad 7 \quad 9 \\
 \hline
 \end{array}$$

$3P + 2 = 9$
 P cannot take any value satisfying the above equation.
 Therefore, this case is not possible.

Case 3:
 $R = 7$
 $Q = 9$

$$\begin{array}{r}
 P \quad 9 \quad 7 \\
 \quad 7 \\
 \hline
 9 \quad 7 \quad 9 \\
 \hline
 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 4:
 $R = 8$
 $Q = 4$

$$\begin{array}{r}
 P \quad 4 \quad 8 \\
 \quad 8 \\
 \hline
 4 \quad 8 \quad 4 \\
 \hline
 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 5:
 $R = 9$
 $Q = 1$
 $T = 7$

Further solving, we get $P = 0$ but this doesn't satisfy the given multiplication.
 Therefore, this case is not possible.



Case 6:

$R = 4$

$Q = 6$

$T = 5$

$$\begin{array}{r} P \quad 6 \quad 4 \\ \quad \quad \quad 4 \\ \hline 6 \quad 5 \quad 6 \\ \hline \end{array}$$

$4P + 2 = 6$

$P = 1$

$$\begin{array}{r} \quad \quad 1 \quad 6 \quad 4 \\ \quad \quad \quad S \quad 4 \\ \hline U \quad 6 \quad 5 \quad 6 \\ \quad \quad S \quad V \\ \hline U \quad W \quad U \quad 6 \\ \hline \end{array}$$

Remaining numbers: 2, 3, 7, 8, 9, 0

S cannot be equal to 0.

S cannot be 7, 8, 9 as the product is a three digit number.

If $S = 3$, it does not satisfy the given condition.

Therefore, only possibility is $S = 2$.

$V = 8, U = 3, W = 9$

Therefore,

@	#	\$!	*	{	}	^
1	6	4	2	5	3	8	9

II:

$$\begin{array}{r} \quad \quad A \quad B \quad C \\ \quad \quad D \quad C \quad E \\ \hline \quad \quad F \quad G \quad F \quad H \\ J \quad I \quad A \quad J \quad C \\ \quad E \quad A \quad D \\ \hline D \quad H \quad B \quad D \quad G \quad H \\ \hline \end{array}$$

$J + 1 = D$

$G + J = 10$ or $G + J + 1 = 10$

It is given,



$$\begin{array}{r} A \quad B \quad C \\ \quad \quad C \\ \hline I \quad A \quad J \quad C \end{array}$$

$$\begin{array}{r} A \quad B \quad C \\ \quad \quad \quad D \\ \hline J \quad E \quad A \quad D \end{array}$$

This implies that,

$C * C = C$ and $C * D = D$

Only possible values satisfying above conditions are $C = 6$ and D is even, i.e. 2/4/8 (cannot be 0 or 6)

Case 1:

$D = 8$

$C = 6$

$J = 7$

If $G = 3, F = 7$ but $J = 7$

$G = 2, F = 6$ but $C = 6$

Therefore, this case is not possible

Case 2:

$D = 4$

$C = 6$

$J = 3$

$G = 7$ (G cannot be 6 as $C = 6$)

$F = 1$

Remaining numbers: 0, 2, 5, 8, 9

$$\begin{array}{r} A \quad B \quad 6 \\ \quad \quad E \\ \hline 1 \quad 7 \quad 1 \quad H \end{array}$$

E cannot take even numbers. E can take either 5 or 9.

If $E = 9, H = 4$ but $D = 4$, therefore E is not equal to 9.

If $E = 5, H = 0$

$1710/5 = 342$

But as per the question the result should end with 6 not 2.

Therefore, this case is not possible.

Case 3:

$D = 2$

$C = 6$

$J = 1$

If $G = 8, F = 2$ but $D = 2$, therefore G is not equal to 8.

Therefore, $G = 9$ and $F = 3$.

Remaining numbers: 0, 4, 5, 7, 8

$$\begin{array}{r} A \quad B \quad 6 \\ \quad \quad E \\ \hline 3 \quad 9 \quad 3 \quad H \end{array}$$



E cannot take even numbers. E can take either 5 or 7.
 If E = 7, H = 2 but D = 2, therefore E is not equal to 7.
 E = 5, H = 0
 $3930/5 = 786$
 Therefore, A = 7, B = 8 and I = 4

A	B	C	D	E	F	G	H	I	J
7	8	6	2	5	3	9	0	4	1

DI# - 246
 $246 = 2 \times 123 = 2 \times 3 \times 41$
 $246 = 2 \times 123 = 2 \times 3 \times 41$
 Number of factors = $(1+1)(1+1)(1+1) = 8$
 The answer is option A.

30. Which of the following is a perfect square?

- A. DE!
- B. ##
- C. !CH@
- D. ^}BA

Sol.

I:

Let @ = P, # = Q, \$ = R, ! = S, * = T, { = U, } = V, ^ = W

P	Q	R	R
U	S	V	Q
U	W	U	Q

$R * R = Q$
 R can take values 2, 3, 4, 7, 8 and 9

Case 1:

- R = 2
- Q = 4
- T = 8

P	4	2
4	8	4

This implies P = 2
 As R = 2, this case is not possible



Case 2:

R = 3

Q = 9

T = 7

$$\begin{array}{r}
 P \quad 9 \quad 3 \\
 \quad \quad \quad 3 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

3P + 2 = 9

P cannot take any value satisfying the above equation.

Therefore, this case is not possible.

Case 3:

R = 7

Q = 9

$$\begin{array}{r}
 P \quad 9 \quad 7 \\
 \quad \quad \quad 7 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

In this case we are getting T = R, therefore, this case is not possible.

Case 4:

R = 8

Q = 4

$$\begin{array}{r}
 P \quad 4 \quad 8 \\
 \quad \quad \quad 8 \\
 \hline
 4 \quad 8 \quad 4
 \end{array}$$

In this case we are getting T = R, therefore, this case is not possible.

Case 5:

R = 9

Q = 1

T = 7

Further solving, we get P = 0 but this doesn't satisfy the given multiplication.

Therefore, this case is not possible.

Case 6:

R = 4

Q = 6

T = 5

$$\begin{array}{r}
 P \quad 6 \quad 4 \\
 \quad \quad \quad 4 \\
 \hline
 6 \quad 5 \quad 6
 \end{array}$$

4P + 2 = 6

P = 1



$$\begin{array}{r}
 164 \\
 \underline{S4} \\
 656 \\
 \underline{USV} \\
 UWU6
 \end{array}$$

Remaining numbers: 2, 3, 7, 8, 9, 0

S cannot be equal to 0.

S cannot be 7, 8, 9 as the product is a three digit number.

If S = 3, it does not satisfy the given condition.

Therefore, only possibility is S = 2.

V = 8, U = 3, W = 9

Therefore,

@	#	\$!	*	{	}	^
1	6	4	2	5	3	8	9

II:

$$\begin{array}{r}
 A B C \\
 D C E \\
 \hline
 F G F H \\
 I A J C \\
 \underline{J E A D} \\
 D H B D G H
 \end{array}$$

$J + 1 = D$

$G + J = 10$ or $G + J + 1 = 10$

It is given,

$$\begin{array}{r}
 A B C \\
 C \\
 \hline
 I A J C
 \end{array}$$

$$\begin{array}{r}
 A B C \\
 D \\
 \hline
 J E A D
 \end{array}$$

This implies that,

$C * C = C$ and $C * D = D$

Only possible values satisfying above conditions are C = 6 and D is even, i.e. 2/4/8 (cannot be 0 or 6)

Case 1:

D = 8

C = 6

J = 7

If G = 3, F = 7 but J = 7

G = 2, F = 6 but C = 6

Therefore, this case is not possible



Case 2:

D = 4

C = 6

J = 3

G = 7 (G cannot be 6 as C = 6)

F = 1

Remaining numbers: 0, 2, 5, 8, 9

$$\begin{array}{r}
 \text{A} \quad \text{B} \quad \text{6} \\
 \text{E} \\
 \hline
 1 \quad 7 \quad 1 \quad \text{H} \\
 \hline
 \end{array}$$

E cannot take even numbers. E can take either 5 or 9.

If E = 9, H = 4 but D = 4, therefore E is not equal to 9.

If E = 5, H = 0

1710/5 = 342

But as per the question the result should end with 6 not 2.

Therefore, this case is not possible.

Case 3:

D = 2

C = 6

J = 1

If G = 8, F = 2 but D = 2, therefore G is not equal to 8.

Therefore, G = 9 and F = 3.

Remaining numbers: 0, 4, 5, 7, 8

$$\begin{array}{r}
 \text{A} \quad \text{B} \quad \text{6} \\
 \text{E} \\
 \hline
 3 \quad 9 \quad 3 \quad \text{H} \\
 \hline
 \end{array}$$

E cannot take even numbers. E can take either 5 or 7.

If E = 7, H = 2 but D = 2, therefore E is not equal to 7.

E = 5, H = 0

3930/5 = 786

Therefore, A = 7, B = 8 and I = 4

A	B	C	D	E	F	G	H	I	J
7	8	6	2	5	3	9	0	4	1

A) DE! = 252 - not a perfect square

B) #*# = 656 - not a perfect square

C) !CH@ = 2601 = 51²

D) ^}BA = 9887 - not a perfect square

Answer is option C.



31. What is the value of '@C^H!'?

Sol.

I:

Let @ = P, # = Q, \$ = R, ! = S, * = T, { = U, } = V, ^ = W

$$\begin{array}{r}
 P \quad Q \quad R \\
 \quad \quad S \quad R \\
 \hline
 U \quad Q \quad T \quad Q \\
 \quad \quad S \quad V \\
 \hline
 U \quad W \quad U \quad Q
 \end{array}$$

R * R = Q

R can take values 2, 3, 4, 7, 8 and 9

Case 1:

R = 2

Q = 4

T = 8

$$\begin{array}{r}
 P \quad 4 \quad 2 \\
 \quad \quad \quad 2 \\
 \hline
 4 \quad 8 \quad 4
 \end{array}$$

This implies P = 2

As R = 2, this case is not possible

Case 2:

R = 3

Q = 9

T = 7

$$\begin{array}{r}
 P \quad 9 \quad 3 \\
 \quad \quad \quad 3 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

3P + 2 = 9

P cannot take any value satisfying the above equation.

Therefore, this case is not possible.

Case 3:

R = 7

Q = 9



$$\begin{array}{r}
 P \quad 9 \quad 7 \\
 \quad 7 \\
 \hline
 9 \quad 7 \quad 9 \\
 \hline
 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 4:
R = 8
Q = 4

$$\begin{array}{r}
 P \quad 4 \quad 8 \\
 \quad 8 \\
 \hline
 4 \quad 8 \quad 4 \\
 \hline
 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 5:
R = 9
Q = 1
T = 7

Further solving, we get $P = 0$ but this doesn't satisfy the given multiplication. Therefore, this case is not possible.

Case 6:
R = 4
Q = 6
T = 5

$$\begin{array}{r}
 P \quad 6 \quad 4 \\
 \quad 4 \\
 \hline
 6 \quad 5 \quad 6 \\
 \hline
 \end{array}$$

$4P + 2 = 6$
 $P = 1$

$$\begin{array}{r}
 \\
 \\
 \hline
 U \quad 6 \quad 5 \quad 6 \\
 U \quad S \quad V \\
 \hline
 U \quad W \quad U \quad 6 \\
 \hline
 \end{array}$$

Remaining numbers: 2, 3, 7, 8, 9, 0
S cannot be equal to 0.
S cannot be 7, 8, 9 as the product is a three digit number.
If $S = 3$, it does not satisfy the given condition.



Therefore, only possibility is $S = 2$.

$V = 8, U = 3, W = 9$

Therefore,

@	#	\$!	*	{	}	^
1	6	4	2	5	3	8	9

II:

		A	B	C	
		D	C	E	
		F	G	F	H
I	A	J	C		
J	E	A	D		
D	H	B	D	G	H

$J + 1 = D$

$G + J = 10$ or $G + J + 1 = 10$

It is given,

	A	B	C		A	B	C	
			C				D	
I	A	J	C		J	E	A	D

This implies that,

$C * C = C$ and $C * D = D$

Only possible values satisfying above conditions are $C = 6$ and D is even, i.e. 2/4/8 (cannot be 0 or 6)

Case 1:

$D = 8$

$C = 6$

$J = 7$

If $G = 3, F = 7$ but $J = 7$

$G = 2, F = 6$ but $C = 6$

Therefore, this case is not possible

Case 2:

$D = 4$

$C = 6$

$J = 3$

$G = 7$ (G cannot be 6 as $C = 6$)

$F = 1$

Remaining numbers: 0, 2, 5, 8, 9



$$\begin{array}{r}
 \text{A} \quad \text{B} \quad \text{6} \\
 \text{E} \\
 \hline
 1 \quad 7 \quad 1 \quad \text{H} \\
 \hline
 \end{array}$$

E cannot take even numbers. E can take either 5 or 9.
 If E = 9, H = 4 but D = 4, therefore E is not equal to 9.
 If E = 5, H = 0
 $1710/5 = 342$
 But as per the question the result should end with 6 not 2.
 Therefore, this case is not possible.

Case 3:
 D = 2
 C = 6
 J = 1
 If G = 8, F = 2 but D = 2, therefore G is not equal to 8.
 Therefore, G = 9 and F = 3.
 Remaining numbers: 0, 4, 5, 7, 8

$$\begin{array}{r}
 \text{A} \quad \text{B} \quad \text{6} \\
 \text{E} \\
 \hline
 3 \quad 9 \quad 3 \quad \text{H} \\
 \hline
 \end{array}$$

E cannot take even numbers. E can take either 5 or 7.
 If E = 7, H = 2 but D = 2, therefore E is not equal to 7.
 E = 5, H = 0
 $3930/5 = 786$
 Therefore, A = 7, B = 8 and I = 4

A	B	C	D	E	F	G	H	I	J
7	8	6	2	5	3	9	0	4	1

@ = 1, C = 6, ^ = 9, H = 0, != 2
 @C^H! = 16902

32. Which one of the following pairs is co-prime?

- A. #2, G3
- B. !F, D1
- C. J\$, }
- D. 0*, !E

Sol.

I:

Let @ = P, # = Q, \$ = R, != S, * = T, { = U, } = V, ^ = W



$$\begin{array}{r}
 P \quad Q \quad R \\
 \quad \quad S \quad R \\
 \hline
 U \quad Q \quad T \quad Q \\
 \quad S \quad V \\
 \hline
 U \quad W \quad U \quad Q
 \end{array}$$

$R * R = Q$

R can take values 2, 3, 4, 7, 8 and 9

Case 1:

$R = 2$

$Q = 4$

$T = 8$

$$\begin{array}{r}
 P \quad 4 \quad 2 \\
 \quad \quad \quad 2 \\
 \hline
 4 \quad 8 \quad 4
 \end{array}$$

This implies $P = 2$

As $R = 2$, this case is not possible

Case 2:

$R = 3$

$Q = 9$

$T = 7$

$$\begin{array}{r}
 P \quad 9 \quad 3 \\
 \quad \quad \quad 3 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

$3P + 2 = 9$

P cannot take any value satisfying the above equation.

Therefore, this case is not possible.

Case 3:

$R = 7$

$Q = 9$

$$\begin{array}{r}
 P \quad 9 \quad 7 \\
 \quad \quad \quad 7 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 4:

$R = 8$

$Q = 4$



$$\begin{array}{r}
 P \quad 4 \quad 8 \\
 \quad \quad \quad 8 \\
 \hline
 4 \quad 8 \quad 4 \\
 \hline
 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 5:

$$R = 9$$

$$Q = 1$$

$$T = 7$$

Further solving, we get $P = 0$ but this doesn't satisfy the given multiplication.

Therefore, this case is not possible.

Case 6:

$$R = 4$$

$$Q = 6$$

$$T = 5$$

$$\begin{array}{r}
 P \quad 6 \quad 4 \\
 \quad \quad \quad 4 \\
 \hline
 6 \quad 5 \quad 6 \\
 \hline
 \end{array}$$

$$4P + 2 = 6$$

$$P = 1$$

$$\begin{array}{r}
 \quad \quad 1 \quad 6 \quad 4 \\
 \quad \quad \quad S \quad 4 \\
 \hline
 \quad \quad 6 \quad 5 \quad 6 \\
 U \quad S \quad V \\
 \hline
 U \quad W \quad U \quad 6 \\
 \hline
 \end{array}$$

Remaining numbers: 2, 3, 7, 8, 9, 0

S cannot be equal to 0.

S cannot be 7, 8, 9 as the product is a three digit number.

If $S = 3$, it does not satisfy the given condition.

Therefore, only possibility is $S = 2$.

$$V = 8, U = 3, W = 9$$

Therefore,

@	#	\$!	*	{	}	^
1	6	4	2	5	3	8	9



Case 3:

D = 2

C = 6

J = 1

If G = 8, F = 2 but D = 2, therefore G is not equal to 8.

Therefore, G = 9 and F = 3.

Remaining numbers: 0, 4, 5, 7, 8

$$\begin{array}{r}
 \text{A} \quad \text{B} \quad 6 \\
 \text{E} \\
 \hline
 3 \quad 9 \quad 3 \quad \text{H} \\
 \hline
 \end{array}$$

E cannot take even numbers. E can take either 5 or 7.

If E = 7, H = 2 but D = 2, therefore E is not equal to 7.

E = 5, H = 0

3930/5 = 786

Therefore, A = 7, B = 8 and I = 4

A	B	C	D	E	F	G	H	I	J
7	8	6	2	5	3	9	0	4	1

A) #2, G3 - 62, 93 (HCF - 31)

B) !F, D1 - 23, 21 (HCF - 1) - co-prime to each other

C) J\$, } - 14, 8 (HCF - 2)

D) 0*, !E - 05, 25 (HCF - 5)

Answer is option B.

33. Find the natural number whose square is nearest to '^B#!E'?

A. 314

B. 307

C. 289

D. 256



Sol.

I:

Let @ = P, # = Q, \$ = R, ! = S, * = T, { = U, } = V, ^ = W

$$\begin{array}{r}
 P \quad Q \quad R \\
 \quad \quad S \quad R \\
 \hline
 U \quad Q \quad T \quad Q \\
 \quad \quad S \quad V \\
 \hline
 U \quad W \quad U \quad Q
 \end{array}$$

$R * R = Q$

R can take values 2, 3, 4, 7, 8 and 9

Case 1:

$R = 2$

$Q = 4$

$T = 8$

$$\begin{array}{r}
 P \quad 4 \quad 2 \\
 \quad \quad \quad 2 \\
 \hline
 4 \quad 8 \quad 4
 \end{array}$$

This implies $P = 2$

As $R = 2$, this case is not possible

Case 2:

$R = 3$

$Q = 9$

$T = 7$

$$\begin{array}{r}
 P \quad 9 \quad 3 \\
 \quad \quad \quad 3 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

$3P + 2 = 9$

P cannot take any value satisfying the above equation.

Therefore, this case is not possible.

Case 3:

$R = 7$

$Q = 9$

$$\begin{array}{r}
 P \quad 9 \quad 7 \\
 \quad \quad \quad 7 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$



In this case we are getting $T = R$, therefore, this case is not possible.

Case 4:

$R = 8$

$Q = 4$

$$\begin{array}{r} P \quad 4 \quad 8 \\ \quad \quad \quad 8 \\ \hline 4 \quad 8 \quad 4 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 5:

$R = 9$

$Q = 1$

$T = 7$

Further solving, we get $P = 0$ but this doesn't satisfy the given multiplication. Therefore, this case is not possible.

Case 6:

$R = 4$

$Q = 6$

$T = 5$

$$\begin{array}{r} P \quad 6 \quad 4 \\ \quad \quad \quad 4 \\ \hline 6 \quad 5 \quad 6 \end{array}$$

$4P + 2 = 6$

$P = 1$

$$\begin{array}{r} \quad \quad 1 \quad 6 \quad 4 \\ \quad \quad \quad S \quad 4 \\ \hline U \quad 6 \quad 5 \quad 6 \\ \quad \quad S \quad V \\ \hline U \quad W \quad U \quad 6 \end{array}$$

Remaining numbers: 2, 3, 7, 8, 9, 0

S cannot be equal to 0.

S cannot be 7, 8, 9 as the product is a three digit number.

If $S = 3$, it does not satisfy the given condition.

Therefore, only possibility is $S = 2$.

$V = 8, U = 3, W = 9$

Therefore,

@	#	\$!	*	{	}	^
1	6	4	2	5	3	8	9



Case 3:

D = 2

C = 6

J = 1

If G = 8, F = 2 but D = 2, therefore G is not equal to 8.

Therefore, G = 9 and F = 3.

Remaining numbers: 0, 4, 5, 7, 8

A	B	6	
		E	
3	9	3	H

E cannot take even numbers. E can take either 5 or 7.

If E = 7, H = 2 but D = 2, therefore E is not equal to 7.

E = 5, H = 0

3930/5 = 786

Therefore, A = 7, B = 8 and I = 4

A	B	C	D	E	F	G	H	I	J
7	8	6	2	5	3	9	0	4	1

$\sqrt{B\#E} = 98625$

$310^2 = 96100, 320^2 = 102400$

The number is between 310^2 and 320^2

$315^2 = 99225, 314^2 = 98596$

$99225 - 98625 = 600; 98625 - 98596 = 29$

It is nearest to 314^2

Answer is 314.

34. Which one of the following is a palindrome?

- A. !E*
- B. #J!C
- C. $\sqrt{D}\{F!G$
- D. @A\$J@

Sol.

I:

Let @ = P, # = Q, \$ = R, ! = S, * = T, { = U, } = V, ^ = W



$$\begin{array}{r}
 P \quad Q \quad R \\
 \quad \quad S \quad R \\
 \hline
 U \quad Q \quad T \quad Q \\
 \quad S \quad V \\
 \hline
 U \quad W \quad U \quad Q
 \end{array}$$

$R * R = Q$

R can take values 2, 3, 4, 7, 8 and 9

Case 1:

$R = 2$

$Q = 4$

$T = 8$

$$\begin{array}{r}
 P \quad 4 \quad 2 \\
 \quad \quad \quad 2 \\
 \hline
 4 \quad 8 \quad 4
 \end{array}$$

This implies $P = 2$

As $R = 2$, this case is not possible

Case 2:

$R = 3$

$Q = 9$

$T = 7$

$$\begin{array}{r}
 P \quad 9 \quad 3 \\
 \quad \quad \quad 3 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$

$3P + 2 = 9$

P cannot take any value satisfying the above equation.

Therefore, this case is not possible.

Case 3:

$R = 7$

$Q = 9$

$$\begin{array}{r}
 P \quad 9 \quad 7 \\
 \quad \quad \quad 7 \\
 \hline
 9 \quad 7 \quad 9
 \end{array}$$



In this case we are getting $T = R$, therefore, this case is not possible.

Case 4:

$R = 8$

$Q = 4$

$$\begin{array}{r} P \quad 4 \quad 8 \\ \quad \quad \quad 8 \\ \hline 4 \quad 8 \quad 4 \end{array}$$

In this case we are getting $T = R$, therefore, this case is not possible.

Case 5:

$R = 9$

$Q = 1$

$T = 7$

Further solving, we get $P = 0$ but this doesn't satisfy the given multiplication. Therefore, this case is not possible.

Case 6:

$R = 4$

$Q = 6$

$T = 5$

$$\begin{array}{r} P \quad 6 \quad 4 \\ \quad \quad \quad 4 \\ \hline 6 \quad 5 \quad 6 \end{array}$$

$4P + 2 = 6$

$P = 1$

$$\begin{array}{r} \quad \quad 1 \quad 6 \quad 4 \\ \quad \quad \quad S \quad 4 \\ \hline U \quad 6 \quad 5 \quad 6 \\ \quad \quad S \quad V \\ \hline U \quad W \quad U \quad 6 \end{array}$$

Remaining numbers: 2, 3, 7, 8, 9, 0

S cannot be equal to 0.

S cannot be 7, 8, 9 as the product is a three digit number.

If $S = 3$, it does not satisfy the given condition.

Therefore, only possibility is $S = 2$.

$V = 8, U = 3, W = 9$

Therefore,

@	#	\$!	*	{	}	^
1	6	4	2	5	3	8	9



Case 3:

D = 2

C = 6

J = 1

If G = 8, F = 2 but D = 2, therefore G is not equal to 8.

Therefore, G = 9 and F = 3.

Remaining numbers: 0, 4, 5, 7, 8

A	B	6	
		E	
3	9	3	H

E cannot take even numbers. E can take either 5 or 7.

If E = 7, H = 2 but D = 2, therefore E is not equal to 7.

E = 5, H = 0

3930/5 = 786

Therefore, A = 7, B = 8 and I = 4

A	B	C	D	E	F	G	H	I	J
7	8	6	2	5	3	9	0	4	1

- A) !E* - 255 - not a palindrome
- B) #J!C - 6126 - not a palindrome
- C) ^D{F!G - 923329 is a palindrome
- D) @A\$J@ - 17411 - not a palindrome

Answer is option C.

Instructions

Skyscraper:

A skyscraper puzzle consists of a square grid of size n*n. Each row and column has to be filled with distinct natural numbers from 1 to n. The number in the grid represents the height of the building in the respective square.

Puzzle: Each number outside the grid reveals the number of buildings visible from that point, looking along the adjacent row or column. Every building blocks all buildings of a lower height from view, while taller buildings are still visible beyond it.

2	2	
3	1	2
2	3	1
1	2	3
3	2	





Example: Consider the above 3*3 grid. '2' above grid number 1*2 represents the two visible buildings from that point.

Skyscraper(Sum):

All the rules are the same as Skyscraper except for the number outside the grid. Instead of representing the number of buildings along the row or column, it will represent the sum of floors of the buildings seen from that point along the adjacent row or column.

	4	5	
3	1	2	
2	3	1	4
1	2	3	
	6	5	

Example: Consider the above 3*3 grid. For column 2, 4 is the sum of floors of the buildings visible from the top point(1+3), and 5 is the sum of the floors of the buildings visible from the bottom point(2+3).

35. Consider a normal 4*4 square grid Skyscraper. What is the sum of the unknown variables?

	a	b	c	2
d				
e				
3				
f				
	g	3	1	2

- A. 20
- B. 21
- C. 15
- D. 24



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Sol. For row 2, since outside on the right-hand side, the number is 4, the only possible combination of the building will be 4-3-2-1 (left to right).

				2	
3	4	3	2	1	4
	3	1	2		

Now consider column 3 bottom grid. Since the number outside the grid is 1, the tallest building is in the bottom square of the column.

				2	
3	4	3	2	1	4
			4		
	3	1	2		

Now consider column 4. Since the number outside the grid at both ends is 2, the building with 4 floors will be situated at (3,4). Also, in column 2, as the number outside the grid is 3, the building with 1 floor will be situated at (3,2). Also, the building with 2 floors will be situated at (4,2), and the one with 4 floors will be situated at (1,2).

				2	
	4				
3	4	3	2	1	4
	1			4	
	2	4			
	3	1	2		



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Since the building with 2 floors is already present in row 4, the building with 3 floors will be situated at (1,4). Thus, after the other arrangements, the final Skyscraper will be

	2	1	4	2	
2	3	4	1	2	2
1	4	3	2	1	4
3	2	1	3	4	1
3	1	2	4	3	2
	3	3	1	2	

So the sum of unknown variables will be $1+3+3+2+2+1+4+2+1+2 = 21$.

36. Consider the following 5*5 grid Skyscraper(sum). How many arrangements are possible for this square grid?

	9		13	11	
12					5
10					
		14			

- A. 1
- B. 2
- C. 4
- D. 6

Sol. Consider row 3 of the grid. The number outside the right side of the grid is 5. Since the sum of floors of the building is 5, the building at the most right square will have 5 floors. Also, in column 5, the number at the top of the grid is 11. Since the building with 5 floors will always be visible, the only possible combination of the first two squares will be 2-4.



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	9		13	11	
				2	
				4	
12				5	5
10					
			14		

In column 3, since only the building with 1 floor is hidden from the bottom, the last row will be filled with building with 2 floors. Now, the building with 4 floors will be either in row 3 or row 4 (based on the position of the building with 1 floor). Since column 5 already has the building with 4 floors in row 4, column 3 will have the building in the third row.

	9		13	11	
		5/1		2	
		1/5		4	
12		4		5	5
		3			
10		2			
			14		

In a similar pattern, in column 4, since only the building with 2 floors is hidden from the top, the column will be filled as follows:

	9		13	11	
		5	1	2	
		1	3/2	4	
12		4	2/3	5	5
		3	4		
10		2	5		
			14		

Row 5: 10 floors from the left end will be filled with buildings with floors 1, 4, and 5.



			9		13		11	
				5	1	2		
				1	3/2	4		
12				4	2/3	5		5
				3	4	1		
10	1	4		2	5	3		
								14

Similarly, the first two rows will be filled as follows:

			9		13		11	
	4	3		5	1	2		
	5/2	2/5		1	3	4		
12	3	1		4	2	5		5
	2/5	5/2		3	4	1		
10	1	4		2	5	3		
								14

Since the position of 2 and 5 is interchangeable, the total number of arrangements will be 2.

37. Consider the following 5*5 grid Skyscraper(sum).

			9		13		11	
12								5
10								
								14

Which of the following combination(s) of column 2 are possible?

Note: For a column 'x' in the form of a-b-c-d-e, a is the element of the first row, b is of the second row and so on.

a



- A. 3-5-1-2-4
- B. 3-5-2-1-4
- C. 3-2-1-5-4
- D. More than one of the above

Sol. Consider row 3 of the grid. The number outside the right side of the grid is 5. Since the sum of floors of the building is 5, the building at the most right square will have 5 floors. Also, in column 5, the number at the top of the grid is 11. Since the building with 5 floors will always be visible, the only possible combination of the first two squares will be 2-4.

	9		13	11	
				2	
				4	
12				5	5
10					
					14

In column 3, since only the building with 1 floor is hidden from the bottom, the last row will be filled with building with 2 floors. Now, the building with 4 floors will be either in row 3 or row 4(based on the position of the building with 1 floor). Since column 5 already has the building with 4 floors in row 4, column 3 will have the building in the third row.

	9		13	11	
			5/1		2
			1/5		4
12			4		5
			3		
10			2		
					14

In a similar pattern, in column 4, since only the building with 2 floors is hidden from the top, the column will be filled as follows:

	9		13	11	
			5	1	2
			1	3/2	4
12			4	2/3	5
			3	4	
10			2	5	
					14



Row 5: 10 floors from the left end will be filled with buildings with floors 1, 4, and 5.

			9		13	11
				5	1	2
				1	3/2	4
12				4	2/3	5
				3	4	1
10	1	4	2	5	3	
						14

Similarly, the first two rows will be filled as follows:

			9		13	11
	4	3	5	1	2	
	5/2	2/5	1	3	4	
12	3	1	4	2	5	
	2/5	5/2	3	4	1	
10	1	4	2	5	3	
						14

Since the positions of buildings with 2 and 5 floors are interchangeable, both options 1 and 3 are correct.

Thus, the correct option is D.

38. Additional Information: (m,n) represents the cell number of the grid. 'm' represents the row number starting with 1 from the top, and 'n' represents the column number starting with 1 from the left.

Consider the following 7*7 square grid Skyscraper(Sum).

			10	11	12	13	14
9							
8							
7							
			17	16			



What is the sum of the left-diagonal elements [diagonal from (1,1) to (7,7)] of the above Skyscraper?

Sol. The final arrangement of the above 7*7 Skyscraper(Sum) is:

	10	11	12	13	14		
9	6	3	4	7	5	2	1
	2	1	7	5	3	4	6
8	3	2	6	4	1	7	5
	1	7	5	6	2	3	4
7	7	5	3	1	4	6	2
	4	6	1	2	7	5	3
	5	4	2	3	6	1	7
			16				

The sum of the left-diagonal elements = 35

39. Consider the below 7*7 grid Skyscraper(sum).

	10	11	12	13	14	
9						
8						
7						
	17	16				

How many arrangements of are possible?

- A. 1
- B. 2
- C. 4
- D. 6



Sol. The final arrangement of the above Skyscraper is

	10	11		12	13	14	
9	6	3	4	7	5	2	1
	2	1	7	5	3	4	6
8	3	2	6	4	1	7	5
	1	7	5	6	2	3	4
7	7	5	3	1	4	6	2
	4	6	1	2	7	5	3
	5	4	2	3	6	1	7
			16				

Thus, only 1 arrangement is possible for the above combination.

40. Additional Information: (m,n) represents the cell number of the grid. 'm' represents the row number starting with 1 from the top, and 'n' represents the column number starting with 1 from the left.

Consider the below 7*7 grid Skyscraper(Sum).

	10	11		12	13	14	
9							
8							
7							
	17		16				

What is the number of floors of the building in the (4,4) grid?

- A. 4
- B. 5
- C. 6
- D. 7

Sol. The final arrangement of the above combinations is:

	10	11		12	13	14	
9	6	3	4	7	5	2	1
	2	1	7	5	3	4	6
8	3	2	6	4	1	7	5
	1	7	5	6	2	3	4
7	7	5	3	1	4	6	2
	4	6	1	2	7	5	3
	5	4	2	3	6	1	7
			16				

At (4,4), the building with 6 floors is situated.



Instructions

The Psychology department of the University of Hyderabad is conducting a focus group on the “Effects of Social Media on Daily Life”. For that, they have invited five people from different cities and professions. These people were seated on seats numbered from 1 to 5 from left to right, and the study was conducted. The personal information of the candidates was stored in the department computer. When the study was over and everyone had left, they realised that the computer had malfunctioned and arranged all the data in ascending order regardless of whom it belonged. The incorrect data table is shown below.

Seat No	First Name	Last Name	City	Profession
1	Anand	Ahluwalia	Bangalore	Chef
2	Baman	Bambani	Delhi	Doctor
3	Chatur	Chaudhary	Hyderabad	Engineer
4	Disha	Damani	Mumbai	Lawyer
5	Eren	Eshwar	Pune	Teacher

Only one value in each column of the above table is correctly placed. Furthermore, the below information is known.

1. The initials for first name and last name are the same for only one person.
2. Eren was sitting at an extreme and was an engineer.
3. Chatur Eshwar was a teacher. Disha was a doctor.
4. Anand was sitting next to the teacher, who was sitting next to the person from Pune.
5. Bambani was from Mumbai. Anand was not from Pune.
6. The person from Delhi was to the immediate left of the person from Mumbai.
7. The number of people sitting between the person from Delhi and Bangalore is equal to the number of people sitting between the person from Hyderabad and Delhi.

Based on the information given, answer the questions that follow.

41. Who is the Chef?

- A. Mr. Chaudhary
- B. Anand
- C. Mr. Ahluwalia
- D. Cannot be determined



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Sol. Only one value in each column of the given table is correctly placed.

We are given that the seats are numbered from 1 - 5 and are set from left to right.

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City					

From point 7, the number of people sitting between Hyderabad and Delhi is equal to those sitting between Delhi and Bangalore.

From point 6, the person from Delhi was to the immediate left of the person from Mumbai.

Thus, two cases can be formed.

Case 1:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

In this case, Mumbai is in the same place as the given table, and all other cities are in different positions. Thus, this case satisfies the given condition.

Case 2:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Bangalore	Pune	Delhi	Mumbai	Hyderabad

In this case, both Bangalore and Mumbai are in the same positions as the given table, violating the given condition. Thus, this case is rejected.

From statement 4, Anand was sitting next to the teacher, who was sitting next to the person from Pune.

From statement 3, Chatur Eshwar is a teacher, and from statement 5, Bambani is from Mumbai; Anand is not from Pune.

Seat No.	1	2	3	4	5
First Name			Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession			Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore



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From the above table, Chatur is in the same position as the provided table. Hence, no other first name can be in the same position as the given table.

From statement 2, Eren is an engineer sitting at an end. At the provided table, too, he is seated at an end (seat no. 5). But Eren can't be in that position and thus, will be placed at seat number 1.

Seat No.	1	2	3	4	5
First Name	Eren		Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession	Engineer		Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From statement 3, Disha is a doctor, and from statement 1, only one person has the same initials for their first and last name. Only Disha can satisfy that condition. Thus, Disha Damani is a doctor.

Baman is in seat number 2 in the provided table. Thus, he will be in seat number 5.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From the above table, the Doctor is in the same position as the provided table. Thus, no other profession will be in its given position. Hence, Chef and Lawyer will be in seats numbered 4 and 5, respectively.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

To satisfy the given condition, one of the last names must be in the same position as the provided table. This is only possible if Ahluwalia is in seat number 1 and Chaudhary is in seat number 5. Thus, we get the final table as given below.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name	Ahluwalia	Damani	Eshwar	Bambani	Chaudhary
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

Thus, Anand is the Chef.

Hence, option B is the correct answer.



42. Who among the following is from Bangalore?

- A. Mr. Chaudhary
- B. Eren
- C. Mr. Eshwar
- D. Cannot be determined

Sol. Only one value in each column of the given table is correctly placed.

We are given that the seats are numbered from 1 - 5 and are set from left to right.

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City					

From point 7, the number of people sitting between Hyderabad and Delhi is equal to those sitting between Delhi and Bangalore.

From point 6, the person from Delhi was to the immediate left of the person from Mumbai.

Thus, two cases can be formed.

Case 1:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

In this case, Mumbai is in the same place as the given table, and all other cities are in different positions. Thus, this case satisfies the given condition.

Case 2:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Bangalore	Pune	Delhi	Mumbai	Hyderabad

In this case, both Bangalore and Mumbai are in the same positions as the given table, violating the given condition. Thus, this case is rejected.

From statement 4, Anand was sitting next to the teacher, who was sitting next to the person from Pune.

From statement 3, Chatur Eshwar is a teacher, and from statement 5, Bambani is from Mumbai; Anand is not from Pune.



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Seat No.	1	2	3	4	5
First Name			Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession			Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From the above table, Chatur is in the same position as the provided table. Hence, no other first name can be in the same position as the given table.

From statement 2, Eren is an engineer sitting at an end. At the provided table, too, he is seated at an end (seat no. 5). But Eren can't be in that position and thus, will be placed at seat number 1.

Seat No.	1	2	3	4	5
First Name	Eren		Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession	Engineer		Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From statement 3, Disha is a doctor, and from statement 1, only one person has the same initials for their first and last name. Only Disha can satisfy that condition. Thus, Disha Damani is a doctor.

Baman is in seat number 2 in the provided table. Thus, he will be in seat number 5.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From the above table, the Doctor is in the same position as the provided table. Thus, no other profession will be in its given position. Hence, Chef and Lawyer will be in seats numbered 4 and 5, respectively.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

To satisfy the given condition, one of the last names must be in the same position as the provided table. This is only possible if Ahluwalia is in seat number 1 and Chaudhary is in seat number 5. Thus, we get the final table as given below.



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Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name	Ahluwalia	Damani	Eshwar	Bambani	Chaudhary
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

Baman Chaudhary is from Bangalore.

Hence, option A is the correct answer.

43. What is the profession of the person from Pune?

- A. Engineer
- B. Doctor
- C. Lawyer
- D. Chef

Sol. Only one value in each column of the given table is correctly placed.

We are given that the seats are numbered from 1 - 5 and are set from left to right.

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City					

From point 7, the number of people sitting between Hyderabad and Delhi is equal to those sitting between Delhi and Bangalore.

From point 6, the person from Delhi was to the immediate left of the person from Mumbai.

Thus, two cases can be formed.

Case 1:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

In this case, Mumbai is in the same place as the given table, and all other cities are in different positions. Thus, this case satisfies the given condition.



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Case 2:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Bangalore	Pune	Delhi	Mumbai	Hyderabad

In this case, both Bangalore and Mumbai are in the same positions as the given table, violating the given condition. Thus, this case is rejected.

From statement 4, Anand was sitting next to the teacher, who was sitting next to the person from Pune.

From statement 3, Chatur Eshwar is a teacher, and from statement 5, Bambani is from Mumbai; Anand is not from Pune.

Seat No.	1	2	3	4	5
First Name			Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession			Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From the above table, Chatur is in the same position as the provided table. Hence, no other first name can be in the same position as the given table.

From statement 2, Eren is an engineer sitting at an end. At the provided table, too, he is seated at an end (seat no. 5). But Eren can't be in that position and thus, will be placed at seat number 1.

Seat No.	1	2	3	4	5
First Name	Eren		Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession	Engineer		Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From statement 3, Disha is a doctor, and from statement 1, only one person has the same initials for their first and last name. Only Disha can satisfy that condition. Thus, Disha Damani is a doctor.

Baman is in seat number 2 in the provided table. Thus, he will be in seat number 5.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore



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From the above table, the Doctor is in the same position as the provided table. Thus, no other profession will be in its given position. Hence, Chef and Lawyer will be in seats numbered 4 and 5, respectively.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

To satisfy the given condition, one of the last names must be in the same position as the provided table. This is only possible if Ahluwalia is in seat number 1 and Chaudhary is in seat number 5. Thus, we get the final table as given below.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name	Ahluwalia	Damani	Eshwar	Bambani	Chaudhary
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

The doctor is from Pune.

Hence, the correct answer is option B.

44. How many people are sitting between Mr. Ahluwalia and Baman?

Enter -1 if the answer can't be determined.

Sol. Only one value in each column of the given table is correctly placed.

We are given that the seats are numbered from 1 - 5 and are set from left to right.

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City					

From point 7, the number of people sitting between Hyderabad and Delhi is equal to those sitting between Delhi and Bangalore.

From point 6, the person from Delhi was to the immediate left of the person from Mumbai.

Thus, two cases can be formed.



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Case 1:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

In this case, Mumbai is in the same place as the given table, and all other cities are in different positions. Thus, this case satisfies the given condition.

Case 2:

Seat No.	1	2	3	4	5
First Name					
Last Name					
Profession					
City	Bangalore	Pune	Delhi	Mumbai	Hyderabad

In this case, both Bangalore and Mumbai are in the same positions as the given table, violating the given condition. Thus, this case is rejected.

From statement 4, Anand was sitting next to the teacher, who was sitting next to the person from Pune.

From statement 3, Chatur Eshwar is a teacher, and from statement 5, Bambani is from Mumbai; Anand is not from Pune.

Seat No.	1	2	3	4	5
First Name			Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession			Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From the above table, Chatur is in the same position as the provided table. Hence, no other first name can be in the same position as the given table.

From statement 2, Eren is an engineer sitting at an end. At the provided table, too, he is seated at an end (seat no. 5). But Eren can't be in that position and thus, will be placed at seat number 1.

Seat No.	1	2	3	4	5
First Name	Eren		Chatur	Anand	
Last Name			Eshwar	Bambani	
Profession	Engineer		Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore



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From statement 3, Disha is a doctor, and from statement 1, only one person has the same initials for their first and last name. Only Disha can satisfy that condition. Thus, Disha Damani is a doctor.

Baman is in seat number 2 in the provided table. Thus, he will be in seat number 5.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher		
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

From the above table, the Doctor is in the same position as the provided table. Thus, no other profession will be in its given position. Hence, Chef and Lawyer will be in seats numbered 4 and 5, respectively.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name		Damani	Eshwar	Bambani	
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

To satisfy the given condition, one of the last names must be in the same position as the provided table. This is only possible if Ahluwalia is in seat number 1 and Chaudhary is in seat number 5. Thus, we get the final table as given below.

Seat No.	1	2	3	4	5
First Name	Eren	Disha	Chatur	Anand	Baman
Last Name	Ahluwalia	Damani	Eshwar	Bambani	Chaudhary
Profession	Engineer	Doctor	Teacher	Chef	Lawyer
City	Hyderabad	Pune	Delhi	Mumbai	Bangalore

Thus, the number of people sitting between Mr. Ahluwalia and Baman is 3.

45. If the HCF and LCM of two natural numbers are 3 and 198, how many pairs of such numbers are possible?

- A. 4
- B. 3
- C. 6
- D. 8

Sol. Let the two numbers be $3a$ and $3b$, where a and b are co-prime numbers.

We know that the product of HCF and LCM is equal to the product of the numbers.

$$3a \times 3b = 3 \times 198$$

$$ab = 66$$



Possible sets of values for a and b are: (1,66), (2, 33), (3, 22) and (6,11).

Since all these numbers are co-prime, there are four possible sets of numbers possible for the given condition.

Hence, option A is the correct answer.

46. An alloy X of copper and zinc is mixed with 5 kg of another alloy having 90% copper in it to get an alloy with 80% copper. If the same amount of the alloy X is mixed with 3 kg of pure copper, we get an alloy with 81.25% copper. What was the amount of alloy X available (in kg)?

- A. 4.5
- B. 5
- C. 3
- D. 3.5

Sol. Let the amount of the alloy available be 'x' kg, and it contains y% copper in it.

When it is mixed with 5 kg of alloy with 90% copper, we get an alloy with 80% copper. Thus,

$$\frac{(xy+5 \times 90)}{(x+5)} = 80$$

$$xy + 450 = 80x + 400$$

$$xy = 80x - 50 \quad \dots(1)$$

When the alloy is mixed with 3 kg of pure copper, we get an alloy with 81.25% copper in it. Thus,

$$\frac{(xy+3 \times 100)}{(x+3)} = 81.25$$

$$xy + 300 = 81.25x + 243.75$$

$$xy = 81.25x - 56.25 \quad \dots(2)$$

Equating (1) and (2) we get

$$80x - 50 = 81.25x - 56.25$$

$$81.25x - 80x = 56.25 - 50$$

$$1.25x = 6.25$$

$$x = 5$$

Hence, option B is the answer.

47. A train of length 200m crosses a pole in 4seconds. If it crosses another train going in the opposite direction at 288 km/hr, completely in 5 seconds, what is the length of the second train?

- A. 200m
- B. 250m
- C. 400m
- D. 450m



Sol. The first train crosses a pole in 4 secs. Thus, the speed of the first train = $\frac{200}{4} = 50$ m/s

The second train's speed = $288 \text{ km/hr} = 288 \times \frac{5}{18} \text{ m/s} = 80 \text{ m/s}$

Let the size of the second train be 'aa' m.

Both trains cross each other completely in 5 seconds. Thus,

$$(200 + a) = (50 + 80) \times 5$$

$$200 + a = 650$$

$$a = 450 \text{ m}$$

Hence, option D is the answer.

48. In a group of people 68% are male and the rest are females. If 75% of the females are working professionals and 63% of the group forms a working population, then approximately what percentage of males are not working ?

- A. 40%
- B. 43%
- C. 55%
- D. 67%

Sol. Let us assume total strength as 100x.

Males = 68x

Females = 32x (working = 24x, non-working = 8x)

Total working = 63x , Total non-working = 37x

So, non working males = 37x - 8x = 29x

Therefore, percentage of non working males is $(29x/68x) \times 100 \approx 43\%$

49. In a base x, $(32_x)^2 = 2124_x$. What is the value of $41_x \times 43_x$ in base x?

- A. 483
- B. 1763
- C. 24023
- D. 3413

Sol. $32_x = (3x + 2)_{10}$

$$2124_x = (2x^3 + x^2 + 2x + 4)_{10}$$

$$(3x + 2)^2 = 2x^3 + x^2 + 2x + 4$$

$$9x^2 + 4 + 12x = 2x^3 + x^2 + 2x + 4$$

$$2x^3 - 8x^2 - 10x = 0$$



$$x(2x^2 - 8x - 10) = 0$$

Base cannot be 0.

$$\text{Thus, } 2x^2 - 8x - 10 = 0$$

$$(x - 5)(2x + 2) = 0$$

$$x = 5, -1$$

Since base cannot be negative, $x = 5$

$$41_5 = 5 \times 4 + 1 = 21_{10}$$

$$43_5 = 5 \times 4 + 3 = 23_{10}$$

$$21 \times 23 = 483_{10}$$

$$483_{10} = 3413_5$$

Hence, option D is the answer.

50. A and B left simultaneously from point P to point Q. A covers each kilometre 2 minutes faster than B. After travelling 18 km, A returns to point P, waits for 66 minutes and starts to Q decreasing the speed by 20%. Both A and B reach Q simultaneously. If A had travelled from P to Q directly without any stops and return journeys, he would have reached Q in 30 minutes. Find the distance between P and Q.

- A. 28 km
- B. 44 km
- C. 48 km
- D. 64 km

Sol. Let the distance between P and Q be 'D'.

It is given,

$$\frac{36}{V_A} + \frac{D}{0.8V_A} + \frac{66}{60} = \frac{D}{V_B} \quad \dots\dots (1)$$

If B travels one kilometre in t minutes, then A travels one kilometre in t - 2 minutes.

$$\text{Speed of A} = \frac{60}{t-2}$$

$$\text{Speed of B} = \frac{60}{t}$$

It is also given that A covers distance D in 30 minutes, i.e. speed of A = $V_A = 2D$ (2)

$$\frac{60}{t-2} = 2D$$

$$60 = 2td - 4D$$

$$t = \frac{60+4D}{2D}$$

$$\text{speed of B} = V_B = \frac{30D}{15+D} \quad \dots\dots (3)$$

Substituting (2) and (3) in (1), we get

$$4D^2 - 147D - 2160 = 0$$

$$4D^2 - 192D + 45D - 2160 = 0$$

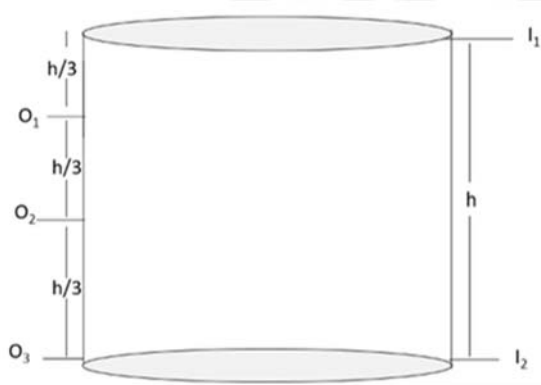
Solving, we get $D = 48$ km

The answer is option C.

51. A tank of height 'h' has two inlet pipes, one at height 'h' and the other at the bottom, and three outlet pipes connected each at height $\frac{2h}{3}$, $\frac{h}{3}$ and 0. Each inlet pipe can fill the tank in 4 hours, and each outlet pipe can empty the tank in 12 hours. If all the inlet and outlet pipes are opened when the tank is empty, how long will it take for the tank to be full?

- A. 2hours 18minutes
- B. 3hours 18minutes
- C. 3hours 8minutes
- D. 2hours 8minutes

Sol. Let the given container be as shown in the figure.



I_1 and I_2 are the inlets at heights 'h' and 0, and O_1 , O_2 , and O_3 are the outlets at heights $\frac{2h}{3}$, $\frac{h}{3}$ and 0, respectively.

O_1 will only work when the water level is between $\frac{2h}{3}$ and h. Similarly, O_2 and O_3 will work when the water level is between $\frac{h}{3}$ & h and 0 and h, respectively.

Initially, the tank is empty.

$$\text{Time required for filling from height } 0 - \frac{h}{3} = \frac{1}{3} \times \frac{1}{\frac{2}{4} - \frac{1}{12}} = \frac{4}{5} = 48 \text{ minutes}$$

$$\text{Time required for filling from height } \frac{h}{3} - \frac{2h}{3} = \frac{1}{3} \times \frac{1}{\frac{2}{4} - \frac{2}{12}} = 1 = 1 \text{ hour}$$

$$\text{Time required for filling from height } \frac{2h}{3} - h = \frac{1}{3} \times \frac{1}{\frac{2}{4} - \frac{3}{12}} = \frac{4}{3} = 1 \text{ hour } 20 \text{ minutes}$$

Thus, the total time required to fill the tank is 48 minutes + 1 hour + 1 hour 20 minutes = 3 hours 08 minutes.

Hence, option C is the answer.



52. $\frac{1}{\log m} + \log n = \frac{13}{3}$, $\log m = \frac{13}{4} - \frac{1}{\log n}$. If $\log m, \log n > 1$, what is the value of $(\log m + 1)(\log n + 1)$?

Sol. Let $\log m = X$ and $\log n = Y$

$$\frac{1}{\log m} + \log n = \frac{13}{3}$$

$$\text{Thus, } \frac{1}{X} + Y = \frac{13}{3}$$

$$\frac{XY+1}{X} = \frac{13}{3} \quad \dots(1)$$

$$\log m = \frac{13}{4} - \frac{1}{\log n}$$

$$\log m + \frac{1}{\log n} = \frac{13}{4}$$

$$X + \frac{1}{Y} = \frac{13}{4}$$

$$\frac{XY+1}{Y} = \frac{13}{4} \quad \dots(2)$$

Dividing (1) by (2), we get

$$\frac{Y}{X} = \frac{4}{3}$$

Let $Y = 4k$ and $X = 3k$

Putting these values in (1), we get

$$\frac{12k^2+1}{3k} = \frac{13}{3}$$

$$12k^2 + 1 = 13k$$

$$(k - 1)(12k - 1) = 0$$

$$k = 1 \text{ or } \frac{1}{12}$$

Since the values of $\log m$ and $\log n$ are greater than 1, $k = 1$

Thus, $\log m = X = 3k = 3$ and $\log n = Y = 4k = 4$

$$(\log m + 1)(\log n + 1) = (3 + 1)(4 + 1) = 20$$

53. Let T_r and S_r be the r^{th} term and the sum of first ' r ' terms of a series respectively. If for an odd number ' n ', $S_n = n$ and $T_n = \frac{T_{n-1}}{n^2} T_m$ (where m being even) is

A. $\frac{2}{m^2+1}$

B. $\frac{2m^2}{m^2+1}$

C. $\frac{(m+1)^2}{(m+1)^2+2}$

D. $\frac{2(m+1)^2}{(m+1)^2+1}$

Sol. $S_n - S_{n-2} = 2$ (for n being odd and $n \geq 3$)

or, $T_n + T_{n-1} = 2$

If n is odd then $n - 1$ will be even

$$\text{or, } \frac{T_{n-1}}{n^2} + T_{n-1} = 2$$

$$\text{or, } \left(\frac{1}{n^2} + 1\right) T_{n-1} = 2$$

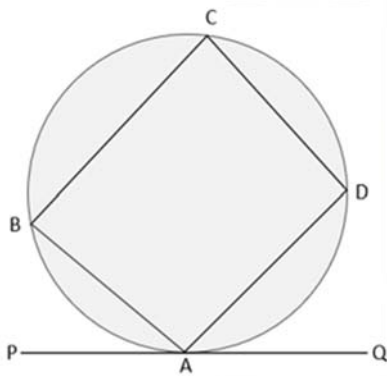
$$\text{or, } \left(\frac{n^2+1}{n^2}\right) T_{n-1} = 2$$

$$\text{or, } T_{n-1} = \frac{2n^2}{n^2+1}$$

Replacing $(n - 1)$ with m , we get

$$T_m = \frac{2(m+1)^2}{(m+1)^2+1}$$

54. The quadrilateral ABCD is inscribed in a circle with tangent PQ at A. $\angle BAP = 15^\circ$ and $\angle DAQ = 45^\circ$. If $AB = CD = 2$ units, what is the value of $BC - AD$?



A. 4

B. $2\sqrt{2}$

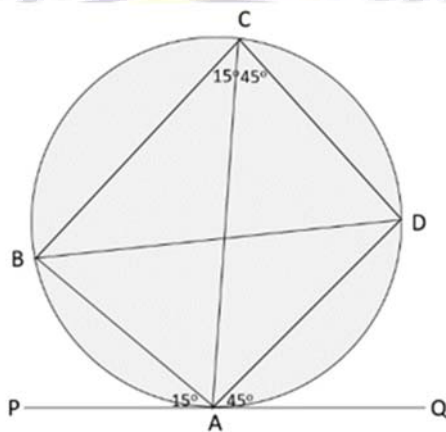
C. 2

D. 5

Sol. Using the alternate segment theorem,

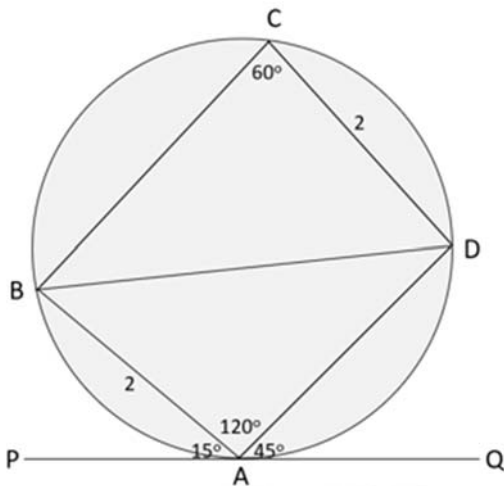
$$\angle ACB = \angle BAP = 15^\circ$$

$$\angle ACD = \angle DAQ = 45^\circ$$



Thus, $\angle BCD = 15 + 45 = 60^\circ$

$\angle BAD = 180 - \angle BCD = 180 - 60 = 120^\circ$ (supplementary angles)



Using the cosine rule in triangles BCD and BAD,

$$BD^2 = BC^2 + CD^2 - 2BC \times CD \times \cos(60) = AB^2 + AD^2 - 2 \times AB \times AD \cos(120)$$

$$BC^2 + 4 - 2BC = 4 + AD^2 + 2AD$$

$$(BC - 1)^2 = (AD + 1)^2$$

$$[(BC-1) + (AD+1)] [(BC-1)-(AD+1)] = 0$$

Either $BC + AD = 0$ which is not possible.

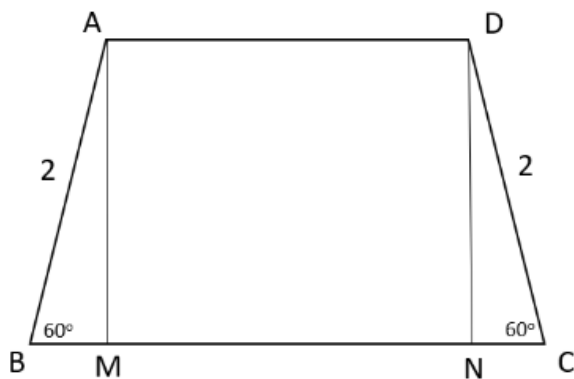
Or, $BC - AD = 2$

Thus, option C is the answer.

Alternate solution:

A cyclic quadrilateral with two opposite sides equal is either a rectangle or an isosceles trapezium.

Here, since the angles are not right-angles, ABCD will be an isosceles trapezium.



AM and AN are altitudes on side BC.

In triangle AMB,

$$\cos(60) = \frac{BM}{AB}$$



Thus, $BM = 2 \times \frac{1}{2} = 1$

Similarly, $CN = 1$

Difference between BC and AD = $BC - AD = BM + CN = 1 + 1 = 2$

Hence, the answer is option C.

55. If the cost of 4 TVs, 3 Washing machines and 6 Microwaves is Rs. 173000 and the cost of 2 TVs, 5 Washing machines and 3 Microwaves is Rs. 139000, what could be the cost of 1 TV, 1 Washing machine and 1 Microwave?

- A. 54000
- B. 43000
- C. 47000
- D. 51000

Sol. Let the prices of a TV, a Washing machine and a Microwave be denoted by T , W and M , respectively.

Thus, $4T + 3W + 6M = 173000$... (1)

And, $2T + 5W + 3M = 139000$... (2)

Multiply (2) by 2 and subtract (1) from it.

$7W = 105000$

$W = 15000$

Putting this value of W in (2) we get

$2T + 75000 + 3M = 139000$

$2T + 3M = 64000$

Dividing this equation by 2, we get

$T + M + 0.5M = 32000$

Adding W to the equation, we get

$T + M + W + 0.5M = 32000 + 15000 = 47000$

We want the cost of 1 TV, 1 washing machine and 1 microwave.

Thus, required cost = $T + M + W$

$T + M + W < T + M + W + 0.5M$

Thus, $T + M + W < 47000$.

Only option B satisfies this inequality.

Hence, option B is the answer.



56. A whole-seller bought a combined total of 50 boards and study tables. He marked up the price of a board by 30% and marked up the cost of each study table by Rs 350. He earned a profit of Rs 15,400 on selling 60% of boards and 8 study tables. He couldn't sell the remaining 7 study tables and the remaining boards. What is the marked price of each study table, if the overall loss is Rs 25,200

Sol. It is given, $B + S = 50$

It is also given that the number of study tables = 15

Number of boards = $50 - 15 = 35$

He earned a profit of Rs 15,400 on selling 60% of boards and 8 study table. Therefore,

$$21 (B_{SP} - B_{CP}) + 8 (S_{SP} - S_{CP}) = 15400$$

$$21 (0.3B_{CP}) + 8 (350) = 15400$$

$$6.3 B_{CP} = 12600$$

$$B_{CP} = 2000$$

$$B_{SP} = 1.3 \times 2000 = 2600$$

$$\text{Overall CP} = 35(2000) + 15 (S_{CP}) = 70000 + 15 S_{CP}$$

$$\text{Overall SP} = 21(2600) + 8(S_{CP} + 3500) = 57400 + 8S_{CP}$$

$$\text{Overall loss} = 25200$$

$$7S_{CP} + 12600 = 25200$$

$$S_{CP} = 1800$$

$$S_{SP} = 1800 + 350 = 2150$$

The answer is 2150.

57. The three sides of a triangle are along the lines $y = 0$, $y = 2\sqrt{2}x$ and $y = 12\sqrt{2} - 2\sqrt{2}x$. If A is the area of the triangle, what is the value of $A\sqrt{2}$?

A. $36\sqrt{2}$

B. $18\sqrt{2}$

C. 18

D. 36

Sol. The given equations of lines are

$$y = 0 \quad \dots(1)$$

$$y = 2\sqrt{2}x \quad \dots(2)$$

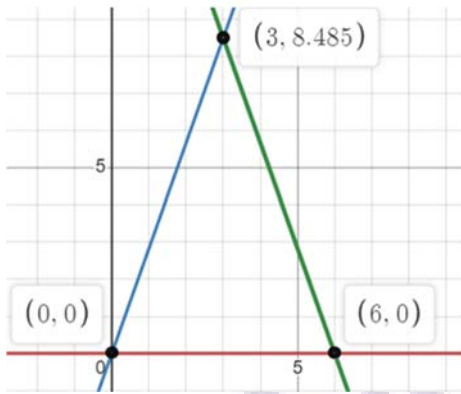
$$y = 12\sqrt{2} - 2\sqrt{2}x \quad \dots(3)$$

Solving (1) and (2), we get the intersection point as (0, 0).

Solving (1) and (3), we get the intersection points as (6, 0).

Solving (2) and (3), we get the intersection points as (3, $6\sqrt{2}$).

Thus, the triangle is as follows.



Let points $(0, 0)$, $(6, 0)$ and $(3, 6\sqrt{2})$ be denoted by A, B and C.

$$\text{Length AB} = \sqrt{(0 - 6)^2 + (0)^2} = 6$$

$$\text{Length AC} = \sqrt{(0 - 3)^2 + (0 - 6\sqrt{2})^2} = \sqrt{81} = 9$$

$$\text{Length BC} = \sqrt{(6 - 3)^2 + (0 - 6\sqrt{2})^2} = \sqrt{81} = 9$$

$$\text{Semi-perimeter} = \frac{6+9+9}{2} = \frac{24}{2} = 12$$

Thus, using Heron's formula,

$$\text{Area} = A = \sqrt{12(12 - 6)(12 - 9)(12 - 9)} = \sqrt{12 \times 6 \times 3 \times 3} = 18\sqrt{2}$$

$$\text{Thus, } A\sqrt{2} = 18\sqrt{2} \times \sqrt{2} = 36$$

58. The score of Bibhu on a certain test is 12.5% more than that of Abha. Bibhu scored 136 marks more than Chandan, and Abha's score is 16 times Chandan's score. If it is known that Chandan has scored 5% of the maximum marks, then what is the difference between maximum marks and the marks scored by Abha?

- A. 8
- B. 16
- C. 32
- D. 64

Sol. Let the scores of Abha, Bibhu and Chandan be A, B and C, respectively.

$$B = \frac{9}{8}A$$

$$B = 136 + C$$

$$A = 16C$$

$$B = \frac{9}{8}(16C) = 18C$$

$$18C = 136 + C$$

$$17C = 136$$

$$C = 8$$

$$\frac{5}{100}(\text{Max}) = 8$$

$$\text{Max} = 20 \times 8 = 160$$

$$A = 16 \times 8 = 128$$

$$\text{Required difference} = 160 - 128 = 32$$

The answer is option C.

59. A die in a pyramid shape with its four sides numbered from 1 to 4 is used in the game “Duopoly”. If three such dice are rolled together, what is the probability that the sum of numbers on the side facing downwards of the dice is a prime number?

A. $\frac{11}{32}$

B. $\frac{5}{8}$

C. $\frac{11}{16}$

D. $\frac{7}{16}$

Sol. The outcomes for a die roll are $\{1,2,3,4\}$

When three such dice are rolled, the possible set of outcomes is $\{(1,1,1), (1,1,2), \dots, (1,1,6), (1,2,1), \dots, (4,4,4)\}$. Thus, a total of $4 \times 4 \times 4 = 64$ outcomes.

We have to find the outcomes where the sum of numbers is a prime number.

The minimum sum is $1 + 1 + 1 = 3$ and the maximum sum is $4 + 4 + 4 = 12$. Thus, the possible prime numbers are 3, 5, 7, 11.

3: $(1,1,1)$ --> only one outcome

5: $(1,1,3), (1,3,1), (3,1,1), (2,2,1), (2,1,2), (1,2,2)$ --> 6 outcomes

7: $(1,2,4), (1,3,3), (2,2,3)$ --> all the arrangements = $6 + 3 + 3 = 12$ outcomes

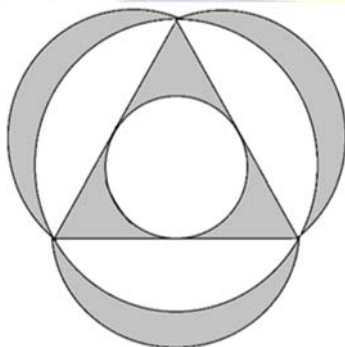
11: $(3,4,4), (4,3,4), (4,4,3)$ --> 3 outcomes.

Thus, total possible outcomes = $1 + 6 + 12 + 3 = 22$

Thus, the probability of getting the sum of faces as a prime number is $= \frac{22}{64} = \frac{11}{32}$

Hence, option A is the correct answer.

60. The figure below shows an equilateral triangle with sides of 6cm. A semicircle is drawn on each of its sides by taking the side as diameter. Find the area of the shaded region.





- A. $18\sqrt{3} - \frac{3\pi}{2}$
- B. $18\sqrt{3} - 3\pi$
- C. $18\sqrt{3} - 39\pi$
- D. $9\sqrt{3} - \frac{3\pi}{2}$

Sol. We are given an equilateral triangle with sides of 6cm.

$$\text{Circumradius for the triangle} = \frac{1}{\sqrt{3}} \times 6 = 2\sqrt{3}$$

$$\text{Inradius for the triangle} = \frac{1}{2\sqrt{3}} \times 6 = \sqrt{3}$$

$$\text{Area of triangle} = \frac{\sqrt{3}}{4} \times 6^2 = 9\sqrt{3}$$

$$\text{Area of each semicircle} = \frac{1}{2} \times \pi \times 3^2 = \frac{9\pi}{2}$$

$$\text{Area of outer circle} = \pi \times (2\sqrt{3})^2 = 12\pi$$

$$\text{Area of inner circle} = \pi \times (\sqrt{3})^2 = 3\pi$$

Area of shaded region = (3 x area of semicircle + area of triangle) - (area of outer circle) + (area of triangle) - (area of inner circle)

$$= \left(3 \times \frac{9\pi}{2} + 9\sqrt{3}\right) - (12\pi) + (9\sqrt{3}) - (3\pi)$$

$$= \frac{27\pi}{2} + 18\sqrt{3} - 15\pi$$

$$= 18\sqrt{3} - \frac{3\pi}{2}$$

Hence, option A is the answer.

61. A can complete a piece of work in 26 days. B is twice as efficient as A, and C is half as efficient as A. All three start working on the project. B leaves after some days of working, and C leaves three days before the work is done. If the work is done in 9 days, what is the difference between the number of days B and C work for?

Sol. A can complete the task in 26 days. Since B is twice as efficient as A, B can complete the job in 13 days; C is half as efficient as A and takes 52 days to complete the work.

Let the total work required for the given task be 52units.

Thus, A, B and C can complete $\frac{52}{26} = 2$, $\frac{52}{13} = 4$ and $\frac{52}{52} = 1$ units of work in a day, respectively.

A works for all nine days. Thus, work done by A = $9 \times 2 = 18$ units

C leaves three days before the work is done. Thus, the work done by C = $(9 - 3) \times 1 = 6$ units.

Let the number of days for which B worked be x . Thus,

$$18 + 4x + 6 = 52$$

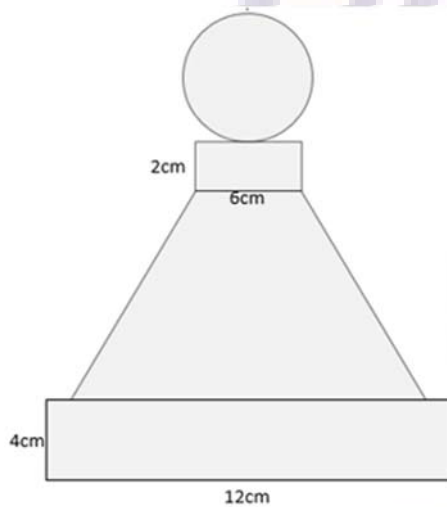
$$4x = 28$$

$$x = 7$$

Thus, the difference between the number of days that B and C work for = $17 - 6 = 1$

Hence, 1 is the correct answer.

62. An award trophy is in the form shown in the diagram. It has a cylindrical base with a diameter of 12 cm and a height of 4 cm. The second section is a frustum of a right circular cone with bottom diameter, top diameter and height equal to 10 cm, 6 cm and 10 cm, respectively. The third section is a cylinder of radius 3 cm and a height of 2 cm, and finally, a spherical top with a radius of 3 cm. The sphere and the frustum are made of glass, while the cylindrical sections are made of brass. What is the ratio of the volume of glass used to the total volume of the trophy?



- A. 299:542
- B. 299:243
- C. 243:542
- D. 243:299

Sol. To calculate the total volume of the award, we have to calculate the volumes of each of the sections.

A) Sphere: radius = $r = 3$ cm

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 3^3 = 36\pi$$

B) Smaller cylinder: radius = $r = 3$ cm, height = $h = 2$ cm

$$\text{Volume} = \pi r^2 h = \pi \times 3^2 \times 2 = 18\pi$$

C) Frustum: top radius = $r = 3$ cm, bottom radius = $R = 5$ cm, height = $h = 10$ cm

$$\text{Volume} = \frac{\pi}{3}h(R^2 + r^2 + Rr) = \frac{\pi}{3} \times 10 \times (5^2 + 3^2 + 5 \times 3) = \frac{490\pi}{3}$$

D) Cylindrical base: radius = $r = 6$ cm, height = $h = 4$ cm

$$\text{Volume} = \pi r^2 h = \pi \times 6^2 \times 4 = 144\pi$$



$$\text{Total volume of the trophy} = 36\pi + 18\pi + 144\pi + \frac{490\pi}{3} = \frac{1084\pi}{3}.$$

$$\text{Total volume of the glass used} = \text{volume of sphere} + \text{volume of frustum} = 36\pi + \frac{490\pi}{3} = \frac{598\pi}{3}$$

$$\text{Thus, the required ratio} = \frac{598\pi}{3} : \frac{1084\pi}{3} = 299 : 542$$

Hence, option A is the answer.

63. While racing on track 1, A beats B by 40m, and while running on track 2, B beats C by 40m. If, on a 300m track, A beats C by 200m, what could be the maximum possible difference between the lengths of tracks 1 and 2 if both the lengths are integers?

- A. 1199
- B. 1200
- C. 1260
- D. 999

Sol. Let the lengths of tracks 1 and 2 be x and y , respectively, and the speeds of A, B and C be a , b and c , respectively.

Since, on track 1, A beats B by 40m, the ratio of speeds of A and B = $a : b = (x) : (x-40)$

While running on track 2, B beats C by 40m. Thus, the ratio of speeds of B and C = $b : c = (y) : (y-40)$

Thus, the ratio $a : b : c = (xy) : (y)(x-40) : (x-40)(y-40)$

We are given that, on a 300m track, A beats C by 200m.

Thus, the ratio of speeds of A and C = $a : c = 300 : 100 = 3 : 1$

$$\text{Thus, } \frac{xy}{(x-40)(y-40)} = \frac{3}{1}.$$

$$xy = 3xy - 120x - 120y + 4800$$

$$120x - 2xy + 120y = 4800$$

$$60x - xy + 60y = 2400$$

$$(x-60)(y-60) = 1200$$

To find the maximum difference between the x and y , the factors of 1200 must be 1 and 1200

$$\text{Let } x-60 = 1, \text{ then } y-60 = 1200$$

$$\text{Thus, } x=61 \text{ and } y=1260.$$

$$\text{Hence, the required difference} = 1260-61=1199.$$

The answer is option A.

64. A wholesaler sells LED bulbs to retailers. To attract customers, he marks up the price by 50% and then provides a discount of 20% on the marked price. While doing the inventory, he found that 20% of the stock was damaged and could not be sold. What



should the new discount percentage be if the wholesaler wants to make the same money as before?

- A. 3%
- B. 8%
- C. 0%
- D. 10%

Sol. Let the cost price of a single bulb be $100x$. Thus, the marked price will be $150x$, and the selling price will be $120x$.

Let the total number of bulbs in the stock be $100y$. Thus, $20y$ bulbs were damaged.

The total amount of money that the wholesaler made earlier = $120x \times 100y = 12000xy$

To make the same money with $80y$ bulbs, the new price of bulbs = $\frac{12000xy}{80y} = 150x$

Thus, the wholesaler will have to sell the bulbs at the marked price to make the same money.

Therefore, 0% discount will be provided.

Hence, option C is the answer.

65. Let f be a function from the set of positive integers to the set of real numbers i.e., $f : N \rightarrow R$, such that $f(1) = 1$ and $f(1) + 2f(2) + 3f(3) + \dots + nf(n) = n(n+1) f(n)$ for $n \geq 2$, if the value of $399 \times f(1995)$ is k , then what is the value of $50k$.

Sol. $f(1) + 2f(2) = (2 \times 3) f(2)$

or, $f(2) = \frac{f(1)}{4} = \frac{1}{4}$

$f(1) + 2f(2) + 3f(3) + \dots + nf(n) = n(n+1) f(n)$ -----(i)

$f(1) + 2f(2) + 3f(3) + \dots + (n-1) f(n-1) = (n-1) nf(n-1)$ -----(ii)

(i) - (ii)

$nf(n) = n(n+1) f(n) - n(n-1) f(n-1)$

or, $n(n-1) f(n-1) = n^2 f(n)$

or, $(n-1) f(n-1) = nf(n)$

Therefore, $2f(2) = 3f(3) = 4f(4) = \dots = 1995 f(1995) = \frac{1}{2}$

$399f(1995) = \frac{1}{5} (1995f(1995)) = \frac{1}{10}$

$k = \frac{1}{10}$

$50k = 50 \times \frac{1}{10} = 5$



Alternate solution:

From the above solution:

$$(n-1) f(n-1) = nf(n)$$

$$f(n) = \frac{(n-1)}{n} f(n-1)$$

$$f(3) = \frac{2}{3} f(2) = \frac{1}{6}$$

$$f(4) = \frac{3}{4} f(3) = \frac{1}{8}$$

$$f(5) = \frac{4}{5} f(4) = \frac{1}{10}$$

Thus, we can see that $f(n) = \frac{1}{2^n}$

$$\text{Thus, } f(1995) = \frac{1}{2^{1995}}$$

$$399 \times f(1995) = 399 \times \frac{1}{2^{1995}} = \frac{1}{10}$$

$$k = \frac{1}{10}$$

$$50k = 50 \times \frac{1}{10} = 5$$

66. The roots of a quadratic equation $x^2 - mx + 5 = 0$ are p and q , and the roots of $x^2 - 2x - n = 0$ are r and s . If r, p, s and q are in an increasing AP, in that order, find the value of $m + n$.

Sol. r, p, s and q are in an increasing AP.

Let r, p, s and q be denoted by $a, (a+d), (a+2d)$ and $(a+3d)$, respectively.

$$\text{For } x^2 - 2x - n = 0$$

$$\text{Sum of roots} = r + s = 2$$

$$a + a + 2d = 2$$

$$2(a + d) = 2$$

$$a + d = 1 \quad \dots(1)$$

$$\text{For } x^2 - mx + 5 = 0,$$

$$\text{Product of roots} = pq = 5$$

$$(a + d)(a + 3d) = 5$$

$$(1)(1 + 2d) = 5$$

$$2d = 4$$

$$d = 2$$

putting this value in (1),

$$a = -1.$$

Thus, the values of r, p, s and q are $-1, 1, 3$ and 5 , respectively.

$$m = \text{sum of roots} = p + q = 1 + 5 = 6$$

$$n = -(\text{product of roots}) = -rs = -(-1)(3) = 3$$

Thus, $m + n = 6 + 3 = 9$.