



DASH CAT 5

Instructions

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

What is gender? This is a question that cuts to the very heart of feminist theory and practice, and is pivotal to current debates in social justice activism about class, identity and privilege [...] The word ‘gender’ originally had a purely grammatical meaning in languages that classify their nouns as masculine, feminine or neuter. But since at least the 1960s, the word has taken on another meaning, allowing us to make a distinction between sex and gender. For feminists, this distinction has been important, because it enables us to acknowledge that some of the differences between women and men are traceable to biology, while others have their roots in environment, culture, upbringing and education - what feminists call ‘gendered socialisation’.

At least, that is the role that the word gender traditionally performed in feminist theory. It used to be a basic, fundamental feminist idea that while sex referred to what is biological, and so perhaps in some sense ‘natural’, gender referred to what is socially constructed. On this view, which for simplicity we can call the radical feminist view, gender refers to the externally imposed set of norms that prescribe and proscribe desirable behaviour to individuals in accordance with morally arbitrary characteristics.

Not only are these norms external to the individual and coercively imposed, but they also represent a binary caste system or hierarchy, a value system with two positions: maleness above femaleness, manhood above womanhood, masculinity above femininity. Individuals are born with the potential to perform one of two reproductive roles, determined at birth, or even before, by the external genitals that the infant possesses. From then on, they will be inculcated into one of two classes in the hierarchy: the superior class if their genitals are convex, the inferior one if their genitals are concave.

From birth, and the identification of sex-class membership that happens at that moment, most female people are raised to be passive, submissive, weak and nurturing, while most male people are raised to be active, dominant, strong and aggressive. This value system, and the process of socialising and inculcating individuals into it, is what a radical feminist means by the word ‘gender’. Understood like this, it’s not difficult to see what is objectionable and oppressive about gender, since it constrains the potential of both male and female people alike, and asserts the superiority of males over females. So, for the radical feminist, the aim is to abolish gender altogether: to stop putting people into pink and blue boxes, and to allow the development of individuals’ personalities and preferences without the coercive influence of this socially enacted value system.

This view of the nature of gender sits uneasily with those who experience gender as in some sense internal and innate, rather than as entirely socially constructed and externally imposed. Such people not only dispute that gender is entirely constructed, but also reject the radical feminist analysis that it is inherently hierarchical with two positions. On this view, which for ease I will call the queer feminist view of gender, what makes the operation of gender oppressive is not that it is socially constructed and coercively imposed: rather, the problem is the prevalence of the belief that there are only two genders.



1. Which of the following options best captures one of the fundamental premises of radical feminist theory?

- A. We live in an oppressive society where women are considered passive, submissive, weak and nurturing and thus, assigned roles accordingly without having any say in the matter.
- B. Society is inherently based on a value system that asserts the superiority of males over females, wherein individuals are sorted into typified roles at birth based on their biological configuration.
- C. Gender is an oppressive societal norm that is equally harmful to both men and women and which should be abolished.
- D. Men are no more dominant or aggressive than women; however, it is solely through existing social constructs that such notions are embedded into our minds.

Sol. The author discusses the underlying beliefs supporting the radical feminist view in the third and fourth paragraphs. He presents how they break down the world into two factions, where one group claims its superiority over the other. In such a society, the biological functions determine social functions, thereby creating a system that reinforces these inherent values. The author comments as follows on the value system: “This value system, and the process of socialising and inculcating individuals into it, is what a radical feminist means by the word ‘gender’. Understood like this, it’s not difficult to see what is objectionable and oppressive about gender, since it constrains the potential of both male and female people alike, and asserts the superiority of males over females. So, for the radical feminist, the aim is to abolish gender altogether: to stop putting people into pink and blue boxes, and to allow the development of individuals’ personalities and preferences without the coercive influence of this socially enacted value system.”

Thus, the entire censure of gender is based on the premise that society is based on a value system that asserts the superiority of males over females and wherein individuals are sorted into typified roles at birth based on their biological configuration. It is in this regard that radical feminists decry gender. Option B correctly presents this idea.

Rather than calling the world oppressive, the author focuses on how the sex-based bifurcation creates a hierarchy with two positions that in turn leads to oppression in the name of gender. Hence, Option A misrepresents the ideas discussed in the passage.

Option C contains the distortion of "equally harmful" to both men and women. This has not been implied in the passage. Hence, we can eliminate option C.

Option D is not implied in the passage and fails to capture the premise of the radical feminist view.

Hence, Option B is the correct choice.

2. Why is the distinction between sex and gender significant for feminists?

- A. While the former is used to identify oneself based on biological factors, the latter is used to fit individuals into predefined stereotypes.
- B. While the former acknowledges differences between men and women attributable to biological elements, the latter emphasises differences based on social factors.



C. While the former encompasses definitions perpetuated by society, the latter represents self-identity.

D. While the former merely points to biological differences between men and women, the latter represents behavioural differences between the two groups.

Sol. The significance of the distinction between sex and gender is spelt out in the first paragraph: “For feminists, this distinction has been important, because it enables us to acknowledge that some of the differences between women and men are traceable to biology, while others have their roots in environment, culture, upbringing and education - what feminists call ‘gendered socialisation’.”

Options A, C and D are either distorted or not implied, while Option B correctly presents the reason.

Hence, Option B is the correct choice.

3. According to the author, which of the following best encompasses the radical feminist view on gender?

A. Whilst sex represents biological differences between men and women, gender showcases the utility of these differences within the social construct.

B. Gender is inherently oppressive in that it removes the choice of determining self-identity from an individual.

C. Though sex and gender are used interchangeably, the former is viewed as natural while the latter is considered artificial.

D. Gender represents socially constructed norms that dictate acceptable behaviour compliant with morally arbitrary principles in society.

Sol. The author presents the radical feminist view on gender as follows: “It used to be a basic, fundamental feminist idea that while sex referred to what is biological, and so perhaps in some sense ‘natural’, gender referred to what is socially constructed. On this view, which for simplicity we can call the radical feminist view, gender refers to the externally imposed set of norms that prescribe and proscribe desirable behaviour to individuals in accordance with morally arbitrary characteristics.” Option D is closest to this description.

Radical feminists do not claim that gender showcases the utility of the differences between men and women within the social construct. Thus, we can eliminate Option A. There is no discussion about determining self-identity, and hence, Option B is irrelevant.

{ It used to be a basic, fundamental feminist idea that while sex referred to what is biological, and so perhaps in some sense ‘natural’, gender referred to what is socially constructed.} While Option C may be true, it fails to completely outline the feminist view of gender. In what way is gender artificial? The imposition of stereotypes based on morally arbitrary principles in society is what makes gender a 'construct' [and perhaps, 'artificial']. Option C fails to capture this idea holistically. Moreover, the radical feminist perception of gender is not derived by drawing a distinction between sex and gender; instead, there is an independent, specific interpretation of gender (as captured in D).

Hence, the correct answer is Option D.



4. All of the following is true about the queer feminist view of gender EXCEPT:

- A. They believe in the prevalence of two genders.
- B. Their view is at odds with the radical feminist view that gender is socially constructed.
- C. They consider gender to be partly internal and not necessarily a binary choice.
- D. They do not agree that the oppressiveness of gender stems from its social construction or coercive imposition.

Sol. Let us examine the validity of the choices:

Option A: False; the author states that queer feminists **do not** believe in the prevalence of only two genders: “On this view, which for ease I will call the queer feminist view of gender, what makes the operation of gender oppressive is not that it is socially constructed and coercively imposed: rather, the problem is the prevalence of the belief that there are only two genders.”

Option B: True; this can be inferred from: “Such people not only dispute that gender is entirely constructed, but also reject the radical feminist analysis that it is inherently hierarchical with two positions.”

Option C: True; we can infer this from: “...experience gender as in some sense internal and innate, rather than as entirely socially constructed and externally imposed... rather, the problem is the prevalence of the belief that there are only two genders...”

Option D: True; we can infer D from the same excerpt as Option B: “On this view, which for ease I will call the queer feminist view of gender, what makes the operation of gender oppressive is not that it is socially constructed and coercively imposed: rather, the problem is the prevalence of the belief that there are only two genders.”

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.

With an eye toward feeding the world’s growing population in a sustainable way, researchers from China and the U.S. may have found a clever solution—in the form of supersizing crops. Transplanting a human protein, known for promoting growth, into crops may engender larger, heavier and more bountiful plants, boosting agricultural yields by a whopping 50 percent, according to the new study in Nature Biotechnology. While the results are promising, experts say that more research needs to be done to test their agricultural mettle and ensure that the gains are replicable.

....The protein responsible for the plants’ extraordinary growth spurt is the human fat mass and obesity-associated protein called FTO. While its associated gene gets a bad rap for increasing one’s obesity risk, the researchers previously reported that the protein is important for regulating growth in humans and other mammals. According to the researchers, FTO chemically modifies RNA strands, which are the short genetic recipes for individual proteins copied right out of the DNA playbook. This modification forces the RNA to produce the protein



it encodes for. Essentially, FTO acts as a master “on” switch that ramps up widespread protein production across multiple RNA strands.

....Plants do not have an FTO-equivalent protein, says He. The chemist suspects that plants usually keep growth under a tight rein to prevent any one molecule from single-handedly wreaking havoc on a plant’s physiology. But in the face of a foreign protein, He says that plants lack any checks and balances to temper the consequences, whatever they may be. To the researchers’ surprise, FTO doesn’t kill off or cripple the plant. Instead, it forces plants to do the exact opposite: size up.

The researchers implanted the human FTO gene into the genomes of rice crops, allowing the plants’ protein machineries to take over and churn out this human molecule on its own. In the greenhouse, the genetically modified crops produced three times more rice than the untweaked plants. Grown out in fields in Beijing, the rice plants were 50 percent heavier and more productive. The same genetic modification also upsized the tubers of potato plants. Plants spiked with FTO also grew longer roots, showed higher photosynthesis levels and were more resistant to droughts.

...“The final yield of a crop is genetically a very complex trait,” he says. Plants are constantly shifting priorities between bulking up or beefing up their defences against diseases and stretches of unfavourable growth conditions. A plant’s surroundings usually have a large say in determining the final yield, but the study’s result seems to override most of these influences. “Because of all these compromises, it’s very unusual to read a report of a very high yield increase with a simple genetic change,” Sablowski adds. “But it’s possible.” He says he would like to see the results replicated in different kinds of environmental conditions, and to better understand how the human FTO protein upends the carefully calibrated inner workings of a plant.

By absolute numbers alone, the FTO-modified rice and potato plants reported in the study have lower yields than commercial varieties, says Donald Ort, a plant biologist at the University of Illinois at Urbana-Champaign who didn’t participate in the study. Only if the same FTO trick increases the productivity of these already high performing strains, then that would be a true breakthrough. “The potential importance of this to agriculture still remains to be proved,” says Ort.

5. Which of the following apprehensions about supersizing crops is true as per the passage?

- A. Whether the supersized crops would have similar nutritional content as regular crops.
- B. Whether the protein used to make supersized crops is easily available.
- C. Whether results from further studies would be as promising as results from the current study.
- D. Whether the introduction of a foreign protein would wreak havoc on the plant's physiology.

Sol. Options A and B have not been mentioned in the passage anywhere. They can be eliminated.

While the results are promising, experts say that more research needs to be done to test their agricultural mettle and ensure that the gains are replicable.



From the above excerpt, we can infer that one of the apprehensions about the crops is whether the gains are replicable, i.e., further studies would yield as meaningful results as this one. Hence, Option C is the correct answer.

The chemist suspects that plants usually keep growth under a tight rein to prevent any one molecule from single-handedly wreaking havoc on a plant's physiology. But in the face of a foreign protein, He says that plants lack any checks and balances to temper the consequences, whatever they may be. To the researchers' surprise, FTO doesn't kill off or cripple the plant. Instead, it forces plants to do the exact opposite: size up.

From the above excerpt, it is clear that the apprehension that FTO could kill off or cripple the plain has been cleared by the study. Hence, Option D can be eliminated too.

6. Which of the following is true about FTO?

- A. It achieves a similar objective in plants and humans: promoting growth.
- B. Plants do not have an FTO-equivalent protein, hence, they cannot keep a check on its effects.
- C. FTO produces the proteins that are responsible for growth in humans.
- D. FTO protein works by stimulating RNAs to perform the task they were designed for.

Sol. A: While its associated gene gets a bad rap for increasing one's obesity risk, the researchers previously reported that the protein is important for regulating growth in humans and other mammals

It has been mentioned in the passage that FTO protein regulates growth. We cannot infer that it necessarily promotes growth in humans. Hence, Option A can be eliminated.

B: But in the face of a foreign protein, He says that plants lack any checks and balances to temper the consequences, whatever they may be.

The option introduces false causation. The lack of check is due to the FTO being a foreign protein, and not because an equivalent is missing in plants. Hence, Option B can be eliminated.

C: According to the researchers, FTO chemically modifies RNA strands, which are the short genetic recipes for individual proteins copied right out of the DNA playbook. This modification forces the RNA to produce the protein it encodes for. Essentially, FTO acts as a master "on" switch that ramps up widespread protein production across multiple RNA strands.

FTO itself does not produce proteins but acts as a stimulant for the same. Hence, Option C can be eliminated too.

D: As mentioned in the above excerpt, FTO acts as a stimulant for RNAs. Hence, Option D is the correct answer.

7. All of the following are the consequences of FTO introduction in plants, EXCEPT:

- A. The plants started producing FTO on their own when the protein gene was introduced into their genome.
- B. Their ability to resist droughts increased, meaning the dependency on water decreased.
- C. The levels of photosynthesis increased and the plants grew longer roots.
- D. The yield and the efficiency of crop production increased significantly.



Sol. The researchers implanted the human FTO gene into the genomes of rice crops, allowing the plants' protein machineries to take over and churn out this human molecule on its own.

From the above line, we can see that Option A is true.

In the greenhouse, the genetically modified crops produced three times more rice than the untweaked plants. Grown out in fields in Beijing, the rice plants were 50 percent heavier and more productive. The same genetic modification also upsized the tubers of potato plants. Plants spiked with FTO also grew longer roots, showed higher photosynthesis levels and were more resistant to droughts.

From the above excerpt, we can see that Options C and D are true.

Though the author mentions that the ability to resist drought increased, the reason for the same has not been cited. It is possible that the dependency on water remained the same, but the plant increased its water retention capacity to use for the future. Hence, the latter part of Option B is incorrect.

Hence, the answer is Option B.

8. Future studies on FTO protein in plants are LEAST likely to focus upon:

- A. A comparison of the performance of these plants in different environments.
- B. The effect of FTO on the physical properties of the plant.
- C. The effect of the introduction of FTO on high-yield crops.
- D. The feasibility of using FTO in regular crops.

Sol. A topic is less likely to be studied if:

1. It has already been dealt with in previous studies.
2. It runs tangent to the discussion mentioned the passage.

He says he would like to see the results replicated in different kinds of environmental conditions, and to better understand how the human FTO protein upends the carefully calibrated inner workings of a plant.

From the above lines, it can be inferred that there is an interest among scientists to see how FTO crops perform under different environmental conditions. Hence, Option A is likely to be a topic of study.

Only if the same FTO trick increases the productivity of these already high performing strains, then that would be a true breakthrough. "The potential importance of this to agriculture still remains to be proved," says Ort.

From the above lines, it is clear that the interest to see whether FTO has uses in high-yield crops and in agriculture is high. Thus, its effect on all crops, regular or high-yield, is important. Hence, Option C and D are likely to be the topics of study.

Since the physical effects of FTO on crops have been studied already (longer roots, bigger size, etc.), it is less likely to be a topic of study again as compared to other topics mentioned. Hence, Option B is the answer.



Instructions

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

In politics you can recover from anything, the former Tory chancellor Norman Lamont used to say. For a very select group of top political escapologists, this is true.

Among the greats of the last century, Churchill, FDR and Mitterrand come to mind. All three started in politics in their 20s and made it their lifelong profession to achieve and retain power at the highest level, like Johnson. And all three did so, recovering in incredible ways from setbacks which at the time appeared terminal. In FDR's case, the onset of polio appeared literally terminal, and certainly a bar to presidential ambitions. But he mastered it, and only in the very last months of his life did he allow himself to be photographed or filmed in a wheelchair. He died in office, having just been elected to an unprecedented fourth term.

....Boris Johnson is still in Houdini's nursery by comparison with these three. But he has some of their more extraordinary characteristics—especially Mitterrand's—and they are on full display in the latest catastrophe of a (so far) 20-year political career which has lurched from crisis to crisis, all of which he has so far survived, including the opening stages of “partygate” and this week's interim Sue Gray report.

First, he has a greater will to power than almost anyone else at the top of British politics. As I describe in my Prospect profile “The Prime Etonian,” his ambition and sense of entitlement are stratospheric and have been since his hugely privileged school and university days at Eton and Oxford. I'm not sure that even Churchill, the grandson of a duke and son of a Tory chancellor, had more ambition and sense of political entitlement than Johnson, the great-grandson of the last sultan of Turkey's interior minister and son of a Tory MEP who wanted similar glory for his most flamboyant offspring.

Secondly, like Mitterrand, he has virtually no shame and virtually no political principles. He manipulates even the greatest of state policies, like Brexit, simply to achieve mastery at any given moment. And he constantly operates at or beyond the limit of the law and conventional norms. His capacity to dodge, switch and manoeuvre is greater than that of anyone else around him for as long as he can maintain power, alliances and momentum to stop his enemies from closing in.

Third, in his early career, he became a celebrity—as did all three of the great survivors I describe above—which puts him on a plane above almost all of those with whom he contends in the political arena, giving him a direct line to the media and the public which he mobilises at key moments of unpopularity.

I am not foolhardy enough to predict Johnson's fate in the clearly perilous oncoming stages of partygate. Criminal charges are possible. Even Houdini came to a grisly end. But if he survives, it will be because he is Britain's greatest modern proponent of political escapology.

9. In the context of the passage, a political escapologist is best described as one who:

- A. can retain power at the top level in spite of terminal setbacks to their career.
- B. is not bound by conventional notions of political manoeuvring and morality.
- C. can retain their political influence and position despite significant setbacks.
- D. specializes in getting people out of political fixes or charges with ease.



Sol. Throughout the passage, a political escapologist is defined as a person who is able to overcome major setbacks in his/her political career in the face of major adversities. Option C comes the closest in capturing this definition, and hence, is the correct answer.

Option A is also close to the correct answer. It is, however, narrow in its definition of who a political escapologist is. It only includes the prominent examples that have been mentioned in the passage and would leave out many other people who escape such political fixes. Hence, Option A can be eliminated.

Options B and D are not apt definitions of the term as explained above. Hence, they can be eliminated too.

10. In the third paragraph, the term 'Houdini's Nursery' has been used to highlight which of the following?

- A. Boris Johnson's expertise as a political escapologist does not stand up to that of other prominent figures mentioned here.
- B. The political catastrophe that Boris Johnson is currently facing will teach him how to become a great political escapologist.
- C. The political career of Boris Johnson is still in its infancy as compared to the careers of other prominent figures mentioned here.
- D. The setback that Boris Johnson is currently facing is not as grave as the ones faced by other prominent figures mentioned here.

Sol. Boris Johnson is still in Houdini's nursery by comparison with these three. But he has some of their more extraordinary characteristics....

The author has used the term political escapologist to denote the four personalities. Since Houdini was considered the greatest escapologist of all time, Houdini's nursery indicates that Boris Johnson's abilities as an escapologist are nothing compared to the other three examples. Also, the line that follows indicates that a comparison of their features and abilities is being made here. Option A comes the closest to capturing this meaning, and hence, is the correct answer.

Option B is close, but it has not been indicated whether the term 'nursery' has been used to denote that the current events are a learning stage for Boris to become better. On the other hand, the line mentioned above indicates that the author wants to highlight the disparity in the abilities of Boris and the other three as political escapologists. Thus, Option A is a better answer than Option B.

The author is not concerned with comparing political careers here. Hence, Option C can be eliminated.

The author is not concerned with comparing the setbacks one faced in his career. Hence, Option D can be eliminated too.



11. The example of Churchill has been used in the passage with Johnson due to the fact that:

- A. Both of them had prominent relatives which helped establish them in power.
- B. Both had a privileged education and a great sense of ambition.
- C. Both were scions of families with notable credentials.
- D. Churchill lacked the ambition and entitlement that Johnson showcases.

Sol. I'm not sure that even Churchill, the grandson of a duke and son of a Tory chancellor, had more ambition and sense of political entitlement than Johnson, the great-grandson of the last sultan of Turkey's interior minister and son of a Tory MEP who wanted similar glory for his most flamboyant offspring.

The author uses the above lines to put the will to power of Johnson in perspective. He evokes Churchill, who was a notable leader and was a successor to a prominent family. Thus, the reason the author can compare the two is the fact that both came from families with exceptional credentials. Had they been from different backgrounds, the comparison would not have been convincing. Thus, the correct answer is Option C.

- A: It has not been mentioned that the relatives helped them achieve power, only that their credentials were significant.
- B: It has not been mentioned that Churchill had a privileged education.
- D: The author has not established that Churchill did not have as much ambition as Johnson. He merely uses it figuratively to show how ambitious Johnson is as compared to other notable leaders with similar profile.

12. Which of the following has been mentioned as a key characteristic that makes Johnson a good political escapologist?

- A. The means to reach a wide audience in times of need.
- B. His ability to manipulate people to his benefit.
- C. His undying popularity that he achieved at a young age.
- D. Similar career trajectory to Churchill and other prominent political escapologists.

Sol. Third, in his early career, he became a celebrity—as did all three of the great survivors I describe above—which puts him on a plane above almost all of those with whom he contends in the political arena, giving him a direct line to the media and the public which he mobilises at key moments of unpopularity.

From the above excerpt, Option A can be inferred. Hence, the correct answer is Option A.

The author mentions that he can manipulate situations to his benefit better than anyone around him. However, manipulation of people has not been mentioned in the passage. Hence, Option B can be eliminated.

His popularity has not been characterised as undying. Rather, his celebrity status allows him to reach people in times of unpopularity. Option C can be eliminated.



It has not been mentioned that his career trajectory was similar to others, but only that he shared certain key characteristics with others. Hence, Option D can be eliminated too.

Instructions

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

In the 1942 short story “Runaround,” one of Isaac Asimov’s characters enumerated “the three fundamental Rules of Robotics.” Robots avoided causing or allowing harm to humans, they obeyed orders and they protected themselves, as long as following one rule didn’t conflict with preceding decrees. We might picture Asimov’s “positronic brains” making autonomous decisions about harm to humans, but that’s not actually how computers affect our well-being every day. Instead of humanoid robots killing people, we have algorithms curating news feeds. As computers further infiltrate our lives, we’ll need to think harder about what kinds of systems to build and how to deploy them, as well as meta-problems like how to decide — and who should decide — these things.

This is the realm of ethics, which may seem distant from the supposed objectivity of math, science and engineering. But deciding what questions to ask about the world and what tools to build has always depended on our ideals and scruples. Studying an abstruse topic like the innards of atoms, for instance, has a clear bearing on both energy and weaponry. “There’s the fundamental fact that computer systems are not value-neutral,” says computer scientist Barbara Grosz of Harvard University, “that when you design them, you bring some set of values into that design.”

One topic that has received a lot of attention from scientists and ethicists is fairness and bias. Algorithms increasingly inform or even dictate decisions about hiring, college admissions, loans and parole. Even if they discriminate less than people do, they can still treat certain groups unfairly, not by design but often because they are trained on biased data. They might predict a person’s future criminal behaviour based on prior arrests, for instance, even though different groups are arrested at different rates for a given amount of crime. And confusingly, there are multiple definitions of fairness, such as equal false-positive rates between groups or equal false-negative rates between groups. A researcher at one conference listed 21 definitions. And the definitions often conflict. In one paper, researchers showed that in most cases it’s mathematically impossible to satisfy three common definitions simultaneously.

Another concern is privacy and surveillance, given that computers can now gather and sort information on their use in a way previously unimaginable. Data on our online behaviour can help predict aspects of our private lives, like sexuality. Facial recognition can also follow us around the real world, helping the police or authoritarian governments...

...Related to privacy is security — hackers can access data that’s locked away, or interfere with pacemakers and autonomous vehicles. Computers can also enable deception. AI can generate content that looks real. Language models might be used to fill the internet with fake news and recruiting material for extremist groups. Generative adversarial networks, a type of deep learning that can generate realistic content, can assist artists or create deepfakes, images or videos showing people doing things they never did.

On social media, we also need to worry about polarization in people’s social, political and other views. Generally, recommendation algorithms optimize engagement (and the platform’s profit through advertising), not civil discourse. Algorithms can also manipulate us in other ways.



Robo-advisers — chatbots for dispensing financial advice or providing customer support — might learn to know what we really need, or to push our buttons and upsell us on extraneous products.

13. If a robot followed "the three fundamental rules of Robotics" strictly, which of the situations might it find itself in?

- A. The robot failed to protect the house from robbery since it had been commanded to do nothing.
- B. The robot had to attack two terrorists who were about to seriously injure a hundred hostages.
- C. The robot separated two people causing physical harm to each other by knocking out the perpetrator.
- D. The robot failed to protect itself from falling down the stairs as it was not given any order to do so.

Sol. The three decrees in the decreasing order of priorities are as follows:

1. Not harm or allow harm to a human in any case.
2. Obey orders.
3. Protect itself.

Thus, a robot would not attack a human in any case. Thus, Options B and C can be eliminated.

In Option D, the robot would not be harming humans if it protected itself. Nor had it been asked to do nothing to protect itself. Hence, in this case, the robot should have followed the third decree. Hence, Option D is also not a possible situation.

In Option A, Decree 1 is of no significance, as there is no mention of any harm to a human.

It has been ordered to do nothing. Thus, even if a robbery was taking place, it would follow the decree highest in priority, in this case, the second decree. Thus, Option A represents a situation in which such a robot might find itself in.

14. What is the primary factor that affects the value-neutrality of a computer system?

- A. The initial set of numerical values that are input by the system designer.
- B. The established ideals and scruples of human society.
- C. The biases that are inherent in the data fed to the system.
- D. The inherent values of the designer who created the system.

Sol. “There’s the fundamental fact that computer systems are not value neutral,” says computer scientist Barbara Grosz of Harvard University, “that when you design them, you bring some set of values into that design.”

In the second paragraph, the author hints that the computer systems are not value-neutral since at the time of designing, some set of values is brought in the design. This refers to ideologies/values that are inherent in the designer.

E.g. If a designer has a certain outlook on performance parameters, he/she might include only quantitative parameters, and leave out certain qualitative parameters. Due to this, the algorithm might identify a person with a good social presence as unfit for the organization.



Thus, the correct answer is Option D.

A: The author is not talking about numerical values but moral/ideological values.

B: Established ideals of society may/may not apply to the individual designing the system.

C: The data can make the system biased and unfair later. The value-neutrality of the system is affected at the time of designing.

15. Which of the following is a possible unfair decision taken by a computer system due to biased data?

A. Based on previous robbery patterns of individuals, an algorithm identifies the potential perpetrators in a recent robbery.

B. An algorithm identifies that a place is unsuitable for setting up a factory due to persisting political instability.

C. A hiring algorithm prioritizes alumni of a certain college due to the college's record generating skilled, successful lawyers.

D. An algorithm identifies the professions a student would do well in based on an aptitude test.

Sol. They might predict a person's future criminal behaviour based on prior arrests, for instance, even though different groups are arrested at different rates for a given amount of crime.

One instance of unfair decision mentioned in the passage mentions that based on the previous record, an algorithm might try to predict the future behaviour of an entity. We need to check which of the following option makes a similar decision:

A: Option A identifies the robbery pattern and then tries to match it with the existing pattern. It does not try to speculate how a person would rob in the future, but already has the method of robbery as a dataset. Option A is not the answer.

B: Since the political stability is persisting, the decision is being taken for the present based on present data. Option B is not the answer.

C: On the basis of the previous record of the college, the algorithm is predicting that the new batch will also be worth hiring. It predicts that the hired alumni might have the potential of being skilled, successful lawyers. Thus, it is equivalent to the decision mentioned in the excerpt; thus, Option C is the correct choice.

D: Option D is not an unfair decision. It does not speculate what the behaviour of the student will be, but using appropriate metrics suggest which behaviour, i.e. the choice of profession, is likely to be the most successful. Option D is not the answer.

16. Which of the following is NOT a downside due to the improvements in algorithms?

A. They become proficient at creating forged content of optimum quality.

B. They can be used by authoritarian governments to gather users' private data.

C. They can cause undesirable shifts in the ideology of users on social media platforms.

D. They can glean sensitive personal data from an individual's online footprint.



Sol. Option A can be inferred from the following: Computers can also enable deception. AI can generate content that looks real. Language models might be used to fill the internet with fake news and recruiting material for extremist groups. Generative adversarial networks, a type of deep learning that can generate realistic content, can assist artists or create deepfakes, images or videos showing people doing things they never did.

Options C can be inferred from the following: On social media, we also need to worry about polarization in people's social, political and other views. Generally, recommendation algorithms optimize engagement (and platforms profit through advertising), not civil discourse.

Option D can be inferred from the following: Another concern is privacy and surveillance, given that computers can now gather and sort information on their use in a way previously unimaginable. Data on our online behaviour can help predict aspects of our private lives, like sexuality.

The passage does not explicitly state that algorithms gather data independently; instead, we are told that algorithms make use of existing gathered data in computers to predict user behaviour or undertake some specific task. The scope of authoritarian governments using algorithms to gather private data is unclear [not inferred]. Hence, Option B has not been mentioned as a downside.

17. 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. The Resolution Foundation says the conflict in Ukraine will push gas and oil inflation in the UK to above 8% this spring - the biggest hit to households since the 1970s.
2. The Joseph Rowntree Foundation says 9 million families on benefits due to low incomes will be £500 worse off on average from April. About 400,000 people could be pulled into poverty.
3. If the money going out soars, while the money coming in shrinks in real terms, millions of families who rely on benefits will be experiencing a socioeconomic catastrophe.
4. New analysis by the Institute for Fiscal Studies (IFS) suggests the impact of the war on energy prices means those measures may now protect consumers from just a fifth of the coming increase.
5. You don't have to be an economist to work out what will happen next.

Sol. A brief reading of the sentences suggests that the passage is about the increasing inflation due to the war and how it would impact households. 1 is an apt starting sentence for the paragraph, which tells the reader about the current situation and that the war will affect the rate of inflation. 5 then highlights that it is obvious what will happen next. 3 then provides the details of the aftermath.

4 talks about certain measures which are not mentioned anywhere else in the paragraph. Hence, 4 is out of context here.

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

When social groups appropriate a particular technology for their own purposes, then social, political, and economic systems can change. An example is the role that the invention of the



printing press played in transforming European society. The fast-growing availability of digitization enables many-to-many communication; think of electronic fora and mailing lists to wikis and Facebook, embattled though it might appear right now. Hence, an increasing number of humans communicate in ways that were not technically possible before. This in turn makes massive self-organization up to a global scale possible.

- A. Availability of digitization, which enables mass communication at an unprecedented level, can be used by social groups to usher in radical changes in different spheres.
- B. Through different times, technologies like the printing press have allowed social groups to mould the social, political, and economic spheres.
- C. The unprecedented mass organization of people at the global level, enabled by digitization, will help social groups alter the world, socially, politically, and economically.
- D. The various spheres of a society are shaped by the decisions taken by the prominent social groups in it, which in turn are enabled by the flourishing technologies.

Sol. The main points of the paragraph are:

1. Social groups can use a particular technology to cause radical changes in many spheres.
2. Digitization allows mass communication at an unprecedented scale and is one such technology.

Option A comes the closest in capturing the above points, and hence, is the correct answer.

B: Misses out on point 2.

C: Option C distorts what has been said in the passage by implying that digitization will help social groups change the world. The author says that it can help bring about changes. There is a mismatch between the level of certainty the author implies and what the option implies.

D: 'Prominent' social groups have not been mentioned anywhere in the paragraph.

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

When women receive performance pay, they benefit less than men: at the higher wage rates, women's bonus from being on performance pay is well below that of men. Research does not support the notion that women themselves tend to abjure jobs linked to performance pay, purportedly because these may be more intense or stressful. More plausible is that performance-pay systems are more open to managerial discretion—especially when 'performance' is difficult to quantify—and can thereby entrench stereotypes. They are further given as part of a reward package and so mainly go to those workers already earning more: those on standard contracts and in high-skill occupations, the higher educated and, generally, men.

- A. Women generally receive less performance pay than men. This can be better explained by the fact that managers provide more rewards to males and hence, entrench stereotypes.
- B. The performance evaluation-based rewards for employees should be made free of stereotypes by making it more objective so that women can be on par with men in difficult to do jobs.
- C. Since men occupy more managerial positions than women, the managerial reward system is bound to be flawed and stereotyped and explains the gender performance-pay gap.



D. The disparity in performance pay between genders is better explained by the subjective nature of evaluation than the reasoning that women avoid such jobs because of the stress involved.

Sol. The main points of the paragraph are as follows:

1. The performance pay for women is less than that of men.
2. Research does not support the reasoning that women avoid high performance pay jobs due to the intensity and stress involved.
3. A more plausible explanation is the subjective nature of evaluation, which entrenches stereotypes.

Option D perfectly captures the above points, and hence, is the correct answer.

A: Distorted. It has not been said that managers provide more rewards to men, but that certain stereotypes can be reinforced due to subjectivity.

B: The author is not advocating anything like Option B does but provides a plausible explanation for a phenomenon.

C: Option C is also a distortion of what the paragraph is trying to convey.

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

1. Methodologically speaking, philosophy grew to value what Thomas Nagel in 1989 called the 'view from nowhere', that is, the detached perspective of a decontextualized and disembodied observer.
2. Today, the view from, and out of, nowhere is common fare among philosophers only when they seek to develop knockout, universal arguments.
3. Although a capacity for critical distance has its utility, the outsized emphasis on abstraction over contextualization left philosophy ill-equipped to consider the historical and cultural embeddedness of its own endeavors.
4. As a 'science', philosophy recoiled not only from metaphysical speculation but from those 'spiritual exercises' once foundational to the Greek practice of philosophy as a 'way of life'.

Sol. A brief reading of the sentences suggests that the paragraph talks about the history of philosophy, and how a detached view of things was to its detriment.

4 sets the context by highlighting how philosophy grew away from metaphysical speculation and spiritual exercises. 1 then explains statement 4 in simple terms - of what that meant in how philosophy was practised. 3 then highlights the shortcoming of this 'detached' method. 2 then sums the paragraph up by highlighting how philosophy has moved away from this practice. Thus, the correct sequence is 4132.



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

1. Lahiri was eventually listed on the song's credits after his record company sued Universal Music Group for more than \$500m.
2. One of their collaborations, Thoda Resham Lagta Hai from the Jyoti soundtrack, was illegally sampled by Dr. Dre on Addictive by the US R&B singer Truth Hurts.
3. His death comes as the Indian film industry faces the passing this month of the legendary singer Lata Mangeshkar, "the nightingale of Bollywood"
4. Lahiri had been close to Lata since his childhood and they worked on numerous projects together. He described her as "not just an icon, but a pillar of the Bollywood industry".

Sol. A brief reading of the sentences suggests that the paragraph is about the passing of Mr. Lahiri and Ms. Mangeshkar and about one of their collaborations.

34 is a mandatory introductory pair, where 3 sets the context and 4 expounds upon the relationship of the two. 21 is another mandatory pair, which gives the details about a controversy regarding one of their collaborations. Thus, the correct order is 3421.

Note that though 3 opens with a pronoun, it does not disqualify it as an opening sentence, since the paragraph is a part of a larger article.

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. In other words, these types of studies may not qualify us to make detailed pronouncements on the cause and effect of any activity on any individual human's brain chemicals.
2. Think of the lab rats who learned to press certain levers to get more sugar or cocaine and who demonstrated the two-pronged pleasure circuit of wanting and liking.
3. Most of what we know about the biological basis of our emotions comes from research on animals.
4. Oxytocin's reputation as the love hormone stems largely from experiments with prairie voles nurturing their young, which showed oxytocin is what makes social bonding so delightful.
5. Wanting is associated with the neurotransmitter dopamine, and liking with the heavenly feelings of cannabinoids and opiates that our bodies produce when we get our desires.

Sol. A brief reading of the sentences suggests that the paragraph is trying to cast a shadow on the generalization of results from animal studies to humans in terms of emotions.

3 is an apt opening sentence that sets the context. 2 then delves more into the topic by highlighting how experiments are done on rats to understand wanting and liking. 4 then highlights another experiment about oxytocin. 1 then sums it up by saying that these experiments may not be indicative of what goes on inside human bodies.

Though wanting has been mentioned in the sentences, 5 is not an apt fit since it starts to run tangent to the discussion of animal studies. Hence, it is out of context here.



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

Some philosophers think that there are sinful actions that don't violate any normative restrictions. Here, Swinburne's distinction between "objective" and "subjective" sins can be helpful. Objective sins occur when a person does what is objectively wrong, whether they realize that it's wrong or not. Subjective sins occur when a person does what they believe to be wrong, acting against their conception of the good (Swinburne 1989: 124). On this differentiation, it's possible for an action to be both objectively and subjectively sinful, objectively but not subjectively sinful (as in the case of people who sin believing they are acting in the right), and subjectively but not objectively sinful (as in the case of a person who acts against an erring conscience).

- A. According to Swinburne, sinful actions that don't violate any normative restrictions but seem wrong to the actor, are subjective sins rather than objective sins.
- B. On basis of the guilt experienced by the actor, Swinburne classifies the sins into objective and subjective, and sin can be classified as either or both of them.
- C. Swinburne's classification of sins as objective - sins that are inherently wrong - and subjective - sins that the actor considers wrong - might help understand sinful actions that do not violate norms.
- D. Based on one's belief system, sin can be either objective or subjective or both, and knowledge of the same can help evade sins concerned with normative restrictions.

Sol. The main points of the passage are as follows:

1. To help with the problem of certain sins not violating normative restrictions, the Swinburne distinction of sins as objective and subjective comes in handy.
2. Definition of objective and subjective sins.

Option C comes the closest in capturing the above two points and is the correct answer.

- A: Fails to define the two sins properly.
- B: Again, fails to define the two types of sin distinctions.
- D: Distorted. Evading sins has not been mentioned here

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

1. Thus, much of the work that's been done in the philosophy of mathematics has been dedicated to attempts to avoid platonism.
2. Platonism is a very attractive view because it provides an extremely natural and pleasing account of mathematical practice and mathematical discourse.
3. They don't believe that there are any such things as abstract objects.
4. Many philosophers do not endorse platonism because they cannot bring themselves to accept its ontology.



Sol. A brief reading of the sentences suggests that the paragraph is about platonism in mathematics and why it is not widely followed.

2 is an apt opening sentence, which introduces platonism and how it is quite attractive. 4 then sets the tone for the rest of the paragraph by mentioning how many philosophers do not endorse it. 3 then adds another reason for the same. 1 then concludes the paragraph by saying that because of these factors, platonism is highly avoided. Hence, the correct sequence is 2431.

Instructions

A, B and C play a game that involves a die. The game is played in rounds.

In each round, A, B, and C rolls a die each in some order(mentioned in the instructions). In a particular round, only the person who rolls the die third has a chance to win the game. If he wins, the game stops and does not proceed to the next round. If he does not win, the game proceeds to the next round and this continues till a player wins. The rounds proceed as follows:

In the first round, first A rolls the die and gets a number, say 'a'. B then rolls the dice and gets a number, say 'b'. Then C rolls a die and gets a number, say 'c'. C wins this round only if $|c-e| \leq 1$, where

$$e = a + b, \text{ if } a + b \leq 6$$

$$e = a + b - 6, \text{ if } a + b > 6$$

If C does not win, the game proceeds to the next round, the second round. In the second round, B rolls first and gets a number say 'b', followed by C who gets a number say 'c', followed by A who gets a number 'a'. A wins this round only if $|a-e| \leq 1$.

$$e = b + c, \text{ if } b + c \leq 6$$

$$e = b + c - 6, \text{ if } b + c > 6$$

If A does not win, the game proceeds to the next round, round three.

In the third round, C throws first, followed by A and then B. B can win this round in a similar fashion, or else we move to Round Four, where again A rolls first, then B and then C.

This keeps on till we get a winner.

25. If x represents a number from 1 to 6 such that when all of the three players roll x in a particular round, that round has a winner. What is the sum of all possible values of x?

- A. 11
- B. 7
- C. 6
- D. 12

Sol. Suppose $x = 1$



$$1 + 1 = 2, |2 - 1| = 1 \leq 1 \text{ Satisfies}$$

Suppose $x = 2$

$$2 + 2 = 4, |4 - 2| = 2 > 1 \text{ Doesn't satisfy}$$

Suppose $x = 3$

$$3 + 3 = 6, |6 - 3| = 3 > 1 \text{ Doesn't satisfy}$$

Suppose $x = 4$

$$4 + 4 = 8$$

$$8 - 6 = 2, |2 - 4| = 2 > 1 \text{ Doesn't satisfy}$$

Suppose $x = 5$

$$5 + 5 = 10$$

$$10 - 6 = 4, |4 - 5| = 1 = 1 \text{ Satisfies}$$

Suppose $x = 6$

$$6 + 6 = 12$$

$$12 - 6 = 6, |6 - 6| = 0 \leq 1 \text{ Satisfies.}$$

Hence there are three different values satisfying the value of x .

$$1 + 5 + 6 = 12.$$

26. If $x, x+a, x+2a$ represent the numbers rolled by A, B, and C in round 1, where a is greater than 0, what is the sum of all possible distinct values of $x+2a$ such that C wins the round?

Sol. The three numbers rolled by A, B, and C are in an increasing AP.

$$1, 2, 3 - C \text{ wins since } |3 - 3| = 0$$

$$2, 3, 4 - C \text{ wins since } |5 - 4| = 1$$

$$3, 4, 5 - C \text{ doesn't win since } |7 - 6 - 5| = 4$$

$$4, 5, 6 - C \text{ doesn't win since } |9 - 6 - 5| = 2$$

$$1, 3, 5 - C \text{ wins because } |1 + 3 - 5| = 1$$

$$2, 4, 6 - C \text{ wins because } |2 + 4 - 6| = 0$$

Hence, the sum of possible values of what C rolls = $3 + 4 + 5 + 6 = 18$

27. If A, B, and C could roll only prime numbers such that in any particular round, all three of A, B, and C roll different numbers, and B wins the game in Round 3, what did A roll in Round 2?

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

Sol. B wins the game. Round 3 decides the winner.



In Round 1 and Round 2, there are no results.

If we consider only the prime numbers, they are 2, 3, and 5.

Now, in Round 2, we need to find out what A has rolled. A is the third person to roll the die in Round 2.

If B and C roll 2 and 3 in any order, A rolls 5. A wins This is not possible.

If B and C roll 3 and 5 in any order, A rolls 2. A again wins. This is not possible.

If B and C roll 2 and 5 in any order, A rolls 3. A doesn't win. This is possible.

Hence, A rolls number - three.

28. In the previous question, what is the minimum possible sum of all the values rolled by A till the end of the game?

Sol. First, for the minimum possible sum, we need to make sure that the game doesn't proceed to Round Four.

If B wins, the game ends in Round 3.

Now, we need to minimise the sum of numbers rolled by A.

Round 1 and Round 2 ended in no-win.

For no-win, we only get the following cases:

2 5 3 and 5 2 3

Now, in round 1, A rolls 2 and in Round 2, A rolls a 3 [as this is the only possibility]

In Round 3, A is the second one to roll.

For this round to have a winner, we can have the following conditions:

2 3 5

3 2 5

5 3 2

3 5 2

A again rolls a 2 for minimising the sum.

Hence, $2 + 3 + 2 = 7$.

29. If A rolls a particular number in all rounds, B rolls a particular number in all rounds and C rolls a particular number in all rounds, such that none of these three numbers is the same, and these numbers form a set $\{x, y, z\}$ such that $x < y < z$, how many such unique sets are possible such that the game never ends?

A. 3

B. 10

C. 8

D. 9



Sol. In this question, all A, B and C get their turns to win. So, let's suppose that $x = 1, y = 2, z = 3$

It doesn't matter who throws 1, who throws 2, and who throws 3.

Let's assume that A throws 2, B throws 3, and C throws 1.

Now, in round 1 - $2 + 3 = 5 \rightarrow |5 - 1| = 4 > 1$ No wins

Round 2 - $3 + 1 = 4 \rightarrow |4 - 2| = 2 > 1$ No wins

Round 3 - $1 + 2 = 3 \rightarrow |3 - 3| = 0$ Win

Hence, we need to find triplets where in no given order, a win is possible.

We have noted down all 20 possibilities for clarity. We can further filter out many entries considering the following facts:

> When 1 is one of the numbers, we can remove all possible consecutive numbers or numbers that differ by 2.

> When 2 is one of the numbers, we can remove most possible numbers that differ by 2, 1, and 3.

1, 2, 3 - $1 + 2 = 3$ [x]

1, 2, 4 - $1 + 2 = 3 \rightarrow 4 - 3 = 1$ [x]

1, 2, 5 - $2 + 5 = 7 - 6 = 1$ [x]

1, 2, 6 - $6 + 2 = 8 - 6 = 2 - 1 = 1$ [x]

1, 3, 4 - $1 + 3 = 4$ [x]

1, 3, 5 - $1 + 3 = 4 \rightarrow 5 - 4 = 1$ [x]

1, 3, 6 - This is possible

1, 4, 5 - $1 + 4 = 5$ [x]

1, 4, 6 - $1 + 4 = 5 \rightarrow 6 - 5 = 1$ [x]

1, 5, 6 - $1 + 5 = 6$ [x]

2, 3, 4 - $2 + 3 = 5 - 4 = 1$ [x]

2, 3, 5 - $2 + 3 = 5$ [x]

2, 3, 6 - $2 + 3 = 5 \rightarrow 6 - 5 = 1$ [x]

2, 4, 5 - $2 + 4 = 6 - 5 = 1$ [x]

2, 4, 6 - $2 + 4 = 6 - 6 = 0$ [x]

2, 5, 6 - This is possible

3, 4, 5 - $4 + 5 = 9 - 6 = 3$ [x]

3, 4, 6 - $4 + 6 - 6 = 4 - 3 = 1$ [x]

3, 5, 6 - This is possible

4, 5, 6 - $4 + 6 - 6 = 4 \rightarrow |4 - 5| = 1$ [x]

Hence, only three sets are there

(1,3,6),(2,5,6) and (3,5,6)



30. In the previous question, how many unique sets have 3 in them?

- A. 3
- B. 4
- C. 2
- D. 6

Sol. In this question, all A, B and C get their turns to win. So, let's suppose that $x = 1, y = 2, z = 3$

It doesn't matter who throws 1, who throws 2, and who throws 3.

Let's assume that A throws 2, B throws 3, and C throws 1.

Now, in round 1 - $2 + 3 = 5 \rightarrow |5 - 1| = 4 > 1$ No wins

Round 2 - $3 + 1 = 4 \rightarrow |4 - 2| = 2 > 1$ No wins

Round 3 - $1 + 2 = 3 \rightarrow |3 - 3| = 0$ Win

Hence, we need to find triplets where in no given order, a win is possible.

We have noted down all 20 possibilities for clarity. We can further filter out many entries considering the following facts:

> When 1 is one of the numbers, we can remove all possible consecutive numbers or numbers that differ by 2.

> When 2 is one of the numbers, we can remove most possible numbers that differ by 2, 1, and 3.

.....

$$1, 2, 3 - 1 + 2 = 3 [x]$$

$$1, 2, 4 - 1 + 2 = 3 \rightarrow 4 - 3 = 1 [x]$$

$$1, 2, 5 - 2 + 5 = 7 - 6 = 1 [x]$$

$$1, 2, 6 - 6 + 2 = 8 - 6 = 2 - 1 = 1 [x]$$

$$1, 3, 4 - 1 + 3 = 4 [x]$$

$$1, 3, 5 - 1 + 3 = 4 \rightarrow 5 - 4 = 1 [x]$$

1, 3, 6 - This is possible

$$1, 4, 5 - 1 + 4 = 5 [x]$$

$$1, 4, 6 - 1 + 4 = 5 \rightarrow 6 - 5 = 1 [x]$$

$$1, 5, 6 - 1 + 5 = 6 [x]$$

$$2, 3, 4 - 2 + 3 = 5 - 4 = 1 [x]$$

$$2, 3, 5 - 2 + 3 = 5 [x]$$

$$2, 3, 6 - 2 + 3 = 5 \rightarrow 6 - 5 = 1 [x]$$

$$2, 4, 5 - 2 + 4 = 6 - 5 = 1 [x]$$

$$2, 4, 6 - 2 + 4 = 6 - 6 = 0 [x]$$



2, 5, 6 - This is possible

$$3, 4, 5 - 4 + 5 = 9 - 6 = 3 [x]$$

$$3, 4, 6 - 4 + 6 - 6 = 4 - 3 = 1 [x]$$

3, 5, 6 - This is possible

$$4, 5, 6 - 4 + 6 - 6 = 4 \rightarrow |4 - 5| = 1 [x]$$

Hence, there are three sets are there

{1,3,6}

{2,5,6}

{3,5,6}

Of these 3, 2 have 3 in them.

Instructions

Amar went to the Island of Mischief for a convention. He met three friends, Ajit, Sujit and Ranjit, each from a different island region, namely Truthdom, Liar-Liar and AltCity. Amar had read that the people from Truthdom always tell the truth, from Liar-Liar lie and AltCity alternate between truth and lie. He asked them about their profession, age and the region to which they belong. They told him that one of them was a doctor, a businessman, and the other a scientist, and their ages were 27, 31 and 37. When Amar asked which one was which, they answered as given below.

Ajit: I am a doctor. Sujit is the youngest. I am from AltCity.

Sujit: I am from AltCity. Ranjit is a businessman. The doctor is younger than the scientist.

Ranjit: I am a doctor. Ajit is 31 years old. Ajit is a businessman.

Answer the following questions.

31. Who is from AltCity?

- A. Ajit
- B. Sujit
- C. Ranjit
- D. Cannot be determined

Sol. Let the person who's a Truth-teller, liar and alternator be denoted by T, L and A. Thus, there are six combinations possible for Ajit, Sujit and Ranjit: TLA, TAL, ATL, ALT, LAT and LTA.

Case1: Ajit is T, Sujit is L and Ranjit is A

From Ajit's statements we get the following table



Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Ranjit is the alternator. Since his first statement is false, his second statement has to be true, and the third statement false. Thus, the table becomes

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar		27
Ranjit	AltCity		37

Sujit is the Liar. From his statements, we get the table as follows.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Sujit's third statement states that the doctor is younger than the Scientist, which is true according to the table. But it has to be false since Sujit is a liar. Thus, this case is dismissed.

Case2: Ajit is T, Sujit is A and Ranjit is L.

From Ajit's statements, we get the table as

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Sujit is the alternator. Since his first statement is true, his second must be false and the third true.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Ranjit is the liar. But the above table makes Ranjit's second statement true. Thus, this case is rejected.

Case 3: Ajit is A, Sujit is T and Ranjit is L.

From Sujit's first statement, he is from AltCity. This contradicts the case statement, which states that he is from Truthdom. Hence, this case is rejected.

Case 4: Ajit is L, Sujit is T and Ranjit is A.

This case is also rejected for the same reason as case 3.



Case 5: Ajit is A, Sujit is L and Ranjit is T.

From Ranjit’s statements, we get the following table.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	
Ranjit	Truthdom	Doctor	

Ajit is the alternator. Since his first statement is false, the second must be true and the third false.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	27
Ranjit	Truthdom	Doctor	37

This case contradicts Ajit's third statement and hence, is rejected.

Case 6: Ajit is L, Sujit is A and Ranjit is T.

From Ranjit’s statement, we get the table below.

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	
Ranjit	Truthdom	Doctor	

Sujit is the alternator. Since his first statement is true, the second false and the third true. Thus,

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	37
Ranjit	Truthdom	Doctor	27

The above table satisfies all of Ajit’s statements and other conditions. Thus, this is a possibility.

Alternate Solution:

A truth-teller will never say that he is from AltCity. Hence, Ranjit is the truth teller.

We can directly take this case and proceed.

From the table, we can observe that Sujit is from AltCity.

Hence, option B is the correct answer.

32. Who is a doctor?

- A. Ajit
- B. Sujit
- C. Ranjit
- D. Cannot be determined



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Sol. Let the person who's a Truth-teller, liar and alternator be denoted by T, L and A. Thus, there are six combinations possible for Ajit, Sujit and Ranjit: TLA, TAL, ATL, ALT, LAT and LTA.

Case1: Ajit is T, Sujit is L and Ranjit is A

From Ajit's statements, we get the following table.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Ranjit is the alternator. Since his first statement is false, his second statement has to be true, and the third statement false. Thus, the table becomes

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar		27
Ranjit	AltCity		37

Sujit is the Liar. From his statements, we get the table as follows.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Sujit's third statement states that the doctor is younger than the Scientist, which is true according to the table. But it has to be false since Sujit is a liar. Thus, this case is dismissed.

Case2: Ajit is T, Sujit is A and Ranjit is L.

From Ajit's statements, we get the table as

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Sujit is the alternator. Since his first statement is true, his second must be false and the third true.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Ranjit is the liar. But the above table makes Ranjit's second statement true. Thus, this case is rejected.



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Case 3: Ajit is A, Sujit is T and Ranjit is L.

From Sujit's first statement, he is from AltCity. This contradicts the case statement, which states that he is from Truthdom. Hence, this case is rejected.

Case 4: Ajit is L, Sujit is T and Ranjit is A.

This case is also rejected for the same reason as case 3.

Case 5: Ajit is A, Sujit is L and Ranjit is T.

From Ranjit's statements, we get the following table.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	
Ranjit	Truthdom	Doctor	

Ajit is the alternator. Since his first statement is false, the second must be true and the third false.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	27
Ranjit	Truthdom	Doctor	37

This case contradicts Ajit's third statement and hence, is rejected.

Case 6: Ajit is L, Sujit is A and Ranjit is T.

From Ranjit's statement, we get the table below.

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	
Ranjit	Truthdom	Doctor	

Sujit is the alternator. Since his first statement is true, the second false and the third true. Thus,

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	37
Ranjit	Truthdom	Doctor	27

The above table satisfies all of Ajit's statements and other conditions. Thus, this is the only possibility.

Alternate Solution:

A truth-teller will never say that he is from AltCity. Hence, Ranjit is the truth-teller.

We can directly take this case and proceed.

From the above table, we can see that Ranjit is a doctor.

Hence, option C is the answer.



33. Who is 31 years old?

- A. Ajit
- B. Sujit
- C. Ranjit
- D. Cannot be determined

Sol. Let the person who's a Truth-teller, liar and alternator be denoted by T, L and A. Thus, there are six combinations possible for Ajit, Sujit and Ranjit: TLA, TAL, ATL, ALT, LAT and LTA.

Case1: Ajit is T, Sujit is L and Ranjit is A

From Ajit's statements, we get the following table.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Ranjit is the alternator. Since his first statement is false, his second statement has to be true, and the third statement false. Thus, the table becomes

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar		27
Ranjit	AltCity		37

Sujit is the Liar. From his statements, we get the table as follows.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Sujit's third statement states that the doctor is younger than the Scientist, which is true according to the table. But it has to be false since Sujit is a liar. Thus, this case is dismissed.

Case2: Ajit is T, Sujit is A and Ranjit is L.

From Ajit's statements, we get the table as

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		



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Sujit is the alternator. Since his first statement is true, his second must be false and the third true.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Ranjit is the liar. But the above table makes Ranjit's second statement true. Thus, this case is rejected.

Case 3: Ajit is A, Sujit is T and Ranjit is L.

From Sujit's first statement, he is from AltCity. This contradicts the case statement, which states that he is from Truthdom. Hence, this case is rejected.

Case 4: Ajit is L, Sujit is T and Ranjit is A.

This case is also rejected for the same reason as case 3.

Case 5: Ajit is A, Sujit is L and Ranjit is T.

From Ranjit's statements, we get the following table.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	
Ranjit	Truthdom	Doctor	

Ajit is the alternator. Since his first statement is false, the second must be true and the third false.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	27
Ranjit	Truthdom	Doctor	37

This case contradicts Ajit's third statement and hence, it is rejected.

Case 6: Ajit is L, Sujit is A and Ranjit is T.

From Ranjit's statement, we get the table below.

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	
Ranjit	Truthdom	Doctor	

Sujit is the alternator. Since his first statement is true, the second false and the third true. Thus,



Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	37
Ranjit	Truthdom	Doctor	27

The above table satisfies all of Ajit’s statements and other conditions. Thus, this is the only possibility.

Alternate Solution:

A truth-teller will never say that he is from AltCity. Hence, Ranjit is the truthteller.

We can directly take this case and proceed.

From the above table, we can see that Ajit is 31 years old.

Hence, option A is the answer.

34. Which region does Ranjit belong to?

- A. Truthdom
- B. Liar-Liar
- C. AltCity
- D. Cannot be determined

Sol. Let the person who's a Truth-teller, liar and alternator be denoted by T, L and A. Thus, there are six combinations possible for Ajit, Sujit and Ranjit: TLA, TAL, ATL, ALT, LAT and LTA.

Case1: Ajit is T, Sujit is L and Ranjit is A

From Ajit’s statements, we get the following table.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Ranjit is the alternator. Since his first statement is false, his second statement has to be true, and the third statement false. Thus, the table becomes

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar		27
Ranjit	AltCity		37

Sujit is the Liar. From his statements, we get the table as follows.



Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Sujit’s third statement states that the doctor is younger than the Scientist, which is true according to the table. But it has to be false since Sujit is a liar. Thus, this case is dismissed.

Case2: Ajit is T, Sujit is A and Ranjit is L.

From Ajit’s statements, we get the table as

Person	City	Profession	Age
Ajit	Truthdom	Doctor	
Sujit	Liar-Liar		27
Ranjit	AltCity		

Sujit is the alternator. Since his first statement is true, his second must be false and the third true.

Person	City	Profession	Age
Ajit	Truthdom	Doctor	31
Sujit	Liar-Liar	Businessman	27
Ranjit	AltCity	Scientist	37

Ranjit is the liar. But the above table makes Ranjit’s second statement true. Thus, this case is rejected.

Case 3: Ajit is A, Sujit is T and Ranjit is L.

From Sujit’s first statement, he is from AltCity. This contradicts the case statement, which states that he is from Truthdom. Hence, this case is rejected.

Case 4: Ajit is L, Sujit is T and Ranjit is A.

This case is also rejected for the same reason as case 3.

Case 5: Ajit is A, Sujit is L and Ranjit is T.

From Ranjit’s statements, we get the following table.

Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	
Ranjit	Truthdom	Doctor	

Ajit is the alternator. Since his first statement is false, the second must be true and the third false.



Person	City	Profession	Age
Ajit	AltCity	Businessman	31
Sujit	Liar-Liar	Scientist	27
Ranjit	Truthdom	Doctor	37

This case contradicts Ajit's third statement and hence, it is rejected.

Case 6: Ajit is L, Sujit is A and Ranjit is T.

From Ranjit's statement, we get the table below.

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	
Ranjit	Truthdom	Doctor	

Sujit is the alternator. Since his first statement is true, the second false and the third true. Thus,

Person	City	Profession	Age
Ajit	Liar-Liar	Businessman	31
Sujit	AltCity	Scientist	37
Ranjit	Truthdom	Doctor	27

The above table satisfies all of Ajit's statements and other conditions. Thus, this is the only possibility.

Alternate Solution:

A truth-teller will never say that he is from AltCity. Hence, Ranjit is the truth teller.

We can directly take this case and proceed.

From the above table, we can see that Ranjit belongs to Truthdom.

Hence, option A is the answer.

Instructions

Five friends, Amit, Ben, Chatur, Deepa and Eren, are playing a game of "Suits and Numbers", in which each player draws one card from a shuffled deck of cards and the number of points obtained by the player is equal to the sum of the number on the card and the value of the suit. The value of suits, spades, clubs, diamonds and hearts are 1, 2, 3 and 4, respectively. Ace, Jack, Queen and King are equal to 1, 11, 12 and 13, respectively.

E.g., if a player draws a 3 of hearts in a round, his score in that round would be $3 + 4 = 7$.

The five friends played four rounds of the game, and the person with the maximum total points at the end of the four rounds was declared the winner. The below partially filled table provides information about the points won by players in each round and their total scores.



	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		

Some additional information about the four rounds is given below.

1. The highest and the lowest possible points were obtained only once. Winners of rounds 1, 2, 3 and 4 are Chatur, Deepa, Amit and Chatur, respectively.
2. Amit and Eren got the same points in round 1. No other pair got the same points in any other round, and no player got the same number of points in more than one round.
3. Amit, Ben and Chatur drew the highest numbered card, each from a different suit, in round 3.
4. Scores of A, D and E are in an arithmetic progression, in increasing order, in round 4. D got the smallest two prime numbers as points in rounds 1 and 3 in any order.
5. Amit's score in round 2 and round 4 is a cube and a square of prime numbers in any order.
6. Eren drew the same numbered cards in rounds 1 and 4 from suits, clubs and spades, in any order.
7. Amit's score in round 4 is equal to Ben's in round 2. The total number of points scored by all the players in round 2 is 51.

Answer the following questions based on the information given above.

35. Who scored the highest total points in the competition?

- A. Amit
- B. Eren
- C. Chatur
- D. Ben

Sol. The partially filled table provided in the question is as follows.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		

From statement 1, we get that the maximum and the minimum possible points are present one time in the table. The maximum possible points are obtained in the case of the king of hearts ($4 + 13 = 17$), and the minimum possible points are obtained in the case of the ace of spades ($1 + 1 = 2$).

From statement 2, A and E got the same points in round 1. Let these points be x .



From statement 4, D got the smallest two prime numbers (2 & 3) in rounds 1 and 3, in any order.

From statement 7, Amit's score in round 4 is equal to Ben's score in round 2. Let this score be y .

Thus, the table becomes,

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x			y	46
Ben	6	y		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2		29
Eren	x	13	6		

Deepa's total score in rounds 1, 2 and 3 is 19 ($14 + 2 + 3$). Thus, her score in round 4 = $29 - 19 = 10$

From statement 5, Amit's score in rounds 2 and 4 is a cube and square of a prime number. The only possible cube is 8. The possible values of squares are 4 and 9. The possible pairs of points are (4, 8) and (9, 8). But in the case of (4, 8), the sum of points in round 2 becomes 46, which contradicts statement 7 and thus, (4, 8) is rejected. Hence, Amit scored 8 and 9 points in rounds 2 and 4 in any order.

From statement 6, Eren drew the same numbered cards in rounds 1 and 4 with suit clubs and spades in any order. Since the difference between points for clubs and spades is 1, the points scored by Eren in round 4 become $(x+1)$ or $(x-1)$

The table now becomes

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x	9/8		8/9	46
Ben	6	8/9		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	x	13	6	$(x+1)/(x-1)$	

From here, we get two cases for the table:

Case 1: Amit scores 8 points in round 4 and 9 points in round 2.

Since the points of A, D and E are in AP in round 4, Eren scores 12 points. Thus, the points of Amit and Eren in round 1 are either 11 or 13.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	11/13	9	18/16	8	46
Ben	6	8	16	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	11/13	13	6	12	



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Amit scores 18 or 16 points from the above table in round 3. The maximum number of points is 17. Thus, 18 is impossible, and if he scores 16, Amit and Ben's scores will be equal in round 3, which is not possible. Therefore, this case is rejected.

Case 2: Amit scores 9 points in round 4 and 8 points in round 2.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	10/12	8	19/17	9	46
Ben	6	9	15	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	10/12	13	6	11	

Amit scores 19 or 17 points in round 3, as given in the above table. But the maximum number of points possible is 17. Thus, Amit scores 17 points in round 3 and 12 points in round 1.

Chatur has drawn a card with the maximum number on it in round 3, according to statement 3. The possible points for Chatur are 17, 16, 15 and 14. But Chatur can't score 17, 16 or 15 points as 17 and 15 are scored by Amit and Ben, and Chatur scores 16 in round 4. Thus, Chatur's score in round 4 is 14.

Hence, the final table becomes.

	Round 1	Round 2	Round 3	Round 4	Total Points	Rank
Amit	12	8	17	9	46	2
Ben	6	9	15	5	35	4
Chatur	15	7	14	16	52	1
Deepa	2/3	14	3/2	10	29	5
Eren	12	13	6	11	42	3

From the above table, we can see that Chatur scored the maximum number of points, and hence, option C is the answer.

36. Who scored the highest possible points in any round?

- A. Ben
- B. Amit
- C. Chatur
- D. Eren

Sol. The partially filled table provided in the question is as follows.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		



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From statement 1, we get that the maximum and the minimum possible points are present one time in the table. The maximum possible points are obtained in the case of the king of hearts ($4 + 13 = 17$), and the minimum possible points are obtained in the case of the ace of spades ($1 + 1 = 2$).

From statement 2, A and E got the same points in round 1. Let these points be x .

From statement 4, D got the smallest two prime numbers (2 & 3) in rounds 1 and 3, in any order.

From statement 7, Amit's score in round 4 is equal to Ben's score in round 2. Let this score be y .

Thus, the table becomes,

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x			y	46
Ben	6	y		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2		29
Eren	x	13	6		

Deepa's total score in rounds 1, 2 and 3 is 19 ($14 + 2 + 3$). Thus, her score in round 4 = $29 - 19 = 10$

From statement 5, Amit's score in rounds 2 and 4 is a cube and square of a prime number. The only possible cube is 8. The possible values of squares are 4 and 9. The possible pairs of points are (4, 8) and (9, 8). But in the case of (4, 8), the sum of points in round 2 becomes 46, which contradicts statement 7 and thus, (4, 8) is rejected. Hence, Amit scored 8 and 9 points in rounds 2 and 4 in any order.

From statement 6, Eren drew the same numbered cards in rounds 1 and 4 with suit clubs and spades in any order. Since the difference between points for clubs and spades is 1, the points scored by Eren in round 4 become $(x+1)$ or $(x-1)$

The table now becomes

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x	9/8		8/9	46
Ben	6	8/9		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	x	13	6	$(x+1)/(x-1)$	

From here, we get two cases for the table:

Case 1: Amit scores 8 points in round 4 and 9 points in round 2.

Since the points of A, D and E are in AP in round 4, Eren scores 12 points. Thus, the points of Amit and Eren in round 1 are either 11 or 13.

Using the total points given, we can calculate some of the remaining points to get the following table.



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	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	11/13	9	18/16	8	46
Ben	6	8	16	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	11/13	13	6	12	

Amit scores 18 or 16 points from the above table in round 3. The maximum number of points is 17. Thus, 18 is impossible, and if he scores 16, Amit and Ben's scores will be equal in round 3, which is not possible. Therefore, this case is rejected.

Case 2: Amit scores 9 points in round 4 and 8 points in round 2.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	10/12	8	19/17	9	46
Ben	6	9	15	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	10/12	13	6	11	

Amit scores 19 or 17 points in round 3, as given in the above table. But the maximum number of points possible is 17. Thus, Amit scores 17 points in round 3 and 12 points in round 1.

Chatur has drawn a card with the maximum number on it in round 3, according to statement 3. The possible points for Chatur are 17, 16, 15 and 14. But Chatur can't score 17, 16 or 15 points as 17 and 15 are scored by Amit and Ben, and Chatur scores 16 in round 4. Thus, Chatur's score in round 4 is 14.

Hence, the final table becomes.

	Round 1	Round 2	Round 3	Round 4	Total Points	Rank
Amit	12	8	17	9	46	2
Ben	6	9	15	5	35	4
Chatur	15	7	14	16	52	1
Deepa	2/3	14	3/2	10	29	5
Eren	12	13	6	11	42	3

The above table shows that Amit scored the highest possible points in a round (17), and hence, option B is the correct answer.

37. In which round the lowest possible points scored by a player were scored?

- A. Round 1
- B. Round 2
- C. Round 3
- D. Either Round 1 or Round 3

Sol. The partially filled table provided in the question is as follows.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		

From statement 1, we get that the maximum and the minimum possible points are present one time in the table. The maximum possible points are obtained in the case of the king of hearts ($4 + 13 = 17$), and the minimum possible points are obtained in the case of the ace of spades ($1 + 1 = 2$).

From statement 2, A and E got the same points in round 1. Let these points be x .

From statement 4, D got the smallest two prime numbers (2 & 3) in rounds 1 and 3, in any order.

From statement 7, Amit's score in round 4 is equal to Ben's score in round 2. Let this score be y .

Thus, the table becomes,

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x			y	46
Ben	6	y		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2		29
Eren	x	13	6		

Deepa's total score in rounds 1, 2 and 3 is 19 ($14 + 2 + 3$). Thus, her score in round 4 = $29 - 19 = 10$

From statement 5, Amit's score in rounds 2 and 4 is a cube and square of a prime number. The only possible cube is 8. The possible values of squares are 4 and 9. The possible pairs of points are (4, 8) and (9, 8). But in the case of (4, 8), the sum of points in round 2 becomes 46, which contradicts statement 7 and thus, (4, 8) is rejected. Hence, Amit scored 8 and 9 points in rounds 2 and 4 in any order.

From statement 6, Eren drew the same numbered cards in rounds 1 and 4 with suit clubs and spades in any order. Since the difference between points for clubs and spades is 1, the points scored by Eren in round 4 become $(x+1)$ or $(x-1)$

The table now becomes

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x	9/8		8/9	46
Ben	6	8/9		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	x	13	6	$(x+1)/(x-1)$	

From here, we get two cases for the table:

Case 1: Amit scores 8 points in round 4 and 9 points in round 2.



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Since the points of A, D and E are in AP in round 4, Eren scores 12 points. Thus, the points of Amit and Eren in round 1 are either 11 or 13.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	11/13	9	18/16	8	46
Ben	6	8	16	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	11/13	13	6	12	

Amit scores 18 or 16 points from the above table in round 3. The maximum number of points is 17. Thus, 18 is impossible, and if he scores 16, Amit and Ben's scores will be equal in round 3, which is not possible. Therefore, this case is rejected.

Case 2: Amit scores 9 points in round 4 and 8 points in round 2.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	10/12	8	19/17	9	46
Ben	6	9	15	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	10/12	13	6	11	

Amit scores 19 or 17 points in round 3, as given in the above table. But the maximum number of points possible is 17. Thus, Amit scores 17 points in round 3 and 12 points in round 1.

Chatur has drawn a card with the maximum number on it in round 3, according to statement 3. The possible points for Chatur are 17, 16, 15 and 14. But Chatur can't score 17, 16 or 15 points as 17 and 15 are scored by Amit and Ben, and Chatur scores 16 in round 4. Thus, Chatur's score in round 4 is 14.

Hence, the final table becomes.

	Round 1	Round 2	Round 3	Round 4	Total Points	Rank
Amit	12	8	17	9	46	2
Ben	6	9	15	5	35	4
Chatur	15	7	14	16	52	1
Deepa	2/3	14	3/2	10	29	5
Eren	12	13	6	11	42	3

The above table shows that Deepa scores the lowest possible points (2) in either round 1 or round 3. Hence, option D is the answer.



38. What is the difference between the highest and the lowest total points scored in the competition?

Sol. The partially filled table provided in the question is as follows.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		

From statement 1, we get that the maximum and the minimum possible points are present one time in the table. The maximum possible points are obtained in the case of the king of hearts ($4 + 13 = 17$), and the minimum possible points are obtained in the case of the ace of spades ($1 + 1 = 2$).

From statement 2, A and E got the same points in round 1. Let these points be x .

From statement 4, D got the smallest two prime numbers (2 & 3) in rounds 1 and 3, in any order.

From statement 7, Amit's score in round 4 is equal to Ben's score in round 2. Let this score be y .

Thus, the table becomes,

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x			y	46
Ben	6	y		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2		29
Eren	x	13	6		

Deepa's total score in rounds 1, 2 and 3 is 19 ($14 + 2 + 3$). Thus, her score in round 4 = $29 - 19 = 10$

From statement 5, Amit's score in rounds 2 and 4 is a cube and square of a prime number. The only possible cube is 8. The possible values of squares are 4 and 9. The possible pairs of points are (4, 8) and (9, 8). But in the case of (4, 8), the sum of points in round 2 becomes 46, which contradicts statement 7 and thus, (4, 8) is rejected. Hence, Amit scored 8 and 9 points in rounds 2 and 4 in any order.

From statement 6, Eren drew the same numbered cards in rounds 1 and 4 with suit clubs and spades in any order. Since the difference between points for clubs and spades is 1, the points scored by Eren in round 4 become $(x+1)$ or $(x-1)$

The table now becomes

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x	9/8		8/9	46
Ben	6	8/9		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	x	13	6	$(x+1)/(x-1)$	



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From here, we get two cases for the table:

Case 1: Amit scores 8 points in round 4 and 9 points in round 2.

Since the points of A, D and E are in AP in round 4, Eren scores 12 points. Thus, the points of Amit and Eren in round 1 are either 11 or 13.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	11/13	9	18/16	8	46
Ben	6	8	16	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	11/13	13	6	12	

Amit scores 18 or 16 points from the above table in round 3. The maximum number of points is 17. Thus, 18 is impossible, and if he scores 16, Amit and Ben's scores will be equal in round 3, which is not possible. Therefore, this case is rejected.

Case 2: Amit scores 9 points in round 4 and 8 points in round 2.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	10/12	8	19/17	9	46
Ben	6	9	15	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	10/12	13	6	11	

Amit scores 19 or 17 points in round 3, as given in the above table. But the maximum number of points possible is 17. Thus, Amit scores 17 points in round 3 and 12 points in round 1.

Chatur has drawn a card with the maximum number on it in round 3, according to statement 3. The possible points for Chatur are 17, 16, 15 and 14. But Chatur can't score 17, 16 or 15 points as 17 and 15 are scored by Amit and Ben, and Chatur scores 16 in round 4. Thus, Chatur's score in round 4 is 14.

Hence, the final table becomes.

	Round 1	Round 2	Round 3	Round 4	Total Points	Rank
Amit	12	8	17	9	46	2
Ben	6	9	15	5	35	4
Chatur	15	7	14	16	52	1
Deepa	2/3	14	3/2	10	29	5
Eren	12	13	6	11	42	3

Thus, the difference between the highest total points (scored by Chatur) and the lowest total points (scored by Deepa) = $52 - 29 = 23$



39. What is the sum of all the points scored in round 1 if Deepa scores the lowest possible points in round 3?

Sol. The partially filled table provided in the question is as follows.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		

From statement 1, we get that the maximum and the minimum possible points are present one time in the table. The maximum possible points are obtained in the case of the king of hearts ($4 + 13 = 17$), and the minimum possible points are obtained in the case of the ace of spades ($1 + 1 = 2$).

From statement 2, A and E got the same points in round 1. Let these points be x .

From statement 4, D got the smallest two prime numbers (2 & 3) in rounds 1 and 3, in any order.

From statement 7, Amit’s score in round 4 is equal to Ben’s score in round 2. Let this score be y .

Thus, the table becomes,

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x			y	46
Ben	6	y		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2		29
Eren	x	13	6		

Deepa’s total score in rounds 1, 2 and 3 is 19 ($14 + 2 + 3$). Thus, her score in round 4 = $29 - 19 = 10$

From statement 5, Amit’s score in rounds 2 and 4 is a cube and square of a prime number. The only possible cube is 8. The possible values of squares are 4 and 9. The possible pairs of points are (4, 8) and (9, 8). But in the case of (4, 8), the sum of points in round 2 becomes 46, which contradicts statement 7 and thus, (4, 8) is rejected. Hence, Amit scored 8 and 9 points in rounds 2 and 4 in any order.

From statement 6, Eren drew the same numbered cards in rounds 1 and 4 with suit clubs and spades in any order. Since the difference between points for clubs and spades is 1, the points scored by Eren in round 4 become $(x+1)$ or $(x-1)$



The table now becomes

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x	9/8		8/9	46
Ben	6	8/9		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	x	13	6	$(x+1)/(x-1)$	

From here, we get two cases for the table:

Case 1: Amit scores 8 points in round 4 and 9 points in round 2.

Since the points of A, D and E are in AP in round 4, Eren scores 12 points. Thus, the points of Amit and Eren in round 1 are either 11 or 13.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	11/13	9	18/16	8	46
Ben	6	8	16	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	11/13	13	6	12	

Amit scores 18 or 16 points from the above table in round 3. The maximum number of points is 17. Thus, 18 is impossible, and if he scores 16, Amit and Ben's scores will be equal in round 3, which is not possible. Therefore, this case is rejected.

Case 2: Amit scores 9 points in round 4 and 8 points in round 2.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	10/12	8	19/17	9	46
Ben	6	9	15	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	10/12	13	6	11	

Amit scores 19 or 17 points in round 3, as given in the above table. But the maximum number of points possible is 17. Thus, Amit scores 17 points in round 3 and 12 points in round 1.

Chatur has drawn a card with the maximum number on it in round 3, according to statement 3. The possible points for Chatur are 17, 16, 15 and 14. But Chatur can't score 17, 16 or 15 points as 17 and 15 are scored by Amit and Ben, and Chatur scores 16 in round 4. Thus, Chatur's score in round 4 is 14.



Hence, the final table becomes.

	Round 1	Round 2	Round 3	Round 4	Total Points	Rank
Amit	12	8	17	9	46	2
Ben	6	9	15	5	35	4
Chatur	15	7	14	16	52	1
Deepa	2/3	14	3/2	10	29	5
Eren	12	13	6	11	42	3

If Deepa scores the lowest possible points (2) in round 3, then her points in round 1 is 3.

Thus, the total number of points scored in round 1 = 12 + 6 + 15 + 3 + 12 = 48

40. If the winner of each round received 5 points for winning, who scored the lowest total points?

- A. Deepa
- B. Ben
- C. Eren
- D. Amit

Sol. The partially filled table provided in the question is as follows.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit					46
Ben	6			5	35
Chatur	15	7		16	
Deepa		14			29
Eren		13	6		

From statement 1, we get that the maximum and the minimum possible points are present one time in the table. The maximum possible points are obtained in the case of the king of hearts (4 + 13 = 17), and the minimum possible points are obtained in the case of the ace of spades (1 + 1 = 2).

From statement 2, A and E got the same points in round 1. Let these points be x.

From statement 4, D got the smallest two prime numbers (2 & 3) in rounds 1 and 3, in any order.

From statement 7, Amit’s score in round 4 is equal to Ben’s score in round 2. Let this score be y.

Thus, the table becomes,

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x			y	46
Ben	6	y		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2		29
Eren	x	13	6		



Deepa’s total score in rounds 1, 2 and 3 is 19 (14 + 2 +3). Thus, her score in round 4 = 29 - 19 = 10

From statement 5, Amit’s score in rounds 2 and 4 is a cube and square of a prime number. The only possible cube is 8. The possible values of squares are 4 and 9. The possible pairs of points are (4, 8) and (9, 8). But in the case of (4, 8), the sum of points in round 2 becomes 46, which contradicts statement 7 and thus, (4, 8) is rejected. Hence, Amit scored 8 and 9 points in rounds 2 and 4 in any order.

From statement 6, Eren drew the same numbered cards in rounds 1 and 4 with suit clubs and spades in any order. Since the difference between points for clubs and spades is 1, the points scored by Eren in round 4 become (x+1) or (x-1)

The table now becomes

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	x	9/8		8/9	46
Ben	6	8/9		5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	x	13	6	(x+1)/(x-1)	

From here, we get two cases for the table:

Case 1: Amit scores 8 points in round 4 and 9 points in round 2.

Since the points of A, D and E are in AP in round 4, Eren scores 12 points. Thus, the points of Amit and Eren in round 1 are either 11 or 13.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	11/13	9	18/16	8	46
Ben	6	8	16	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	11/13	13	6	12	

Amit scores 18 or 16 points from the above table in round 3. The maximum number of points is 17. Thus, 18 is impossible, and if he scores 16, Amit and Ben’s scores will be equal in round 3, which is not possible. Therefore, this case is rejected.

Case 2: Amit scores 9 points in round 4 and 8 points in round 2.

Using the total points given, we can calculate some of the remaining points to get the following table.

	Round 1	Round 2	Round 3	Round 4	Total Points
Amit	10/12	8	19/17	9	46
Ben	6	9	15	5	35
Chatur	15	7		16	
Deepa	2/3	14	3/2	10	29
Eren	10/12	13	6	11	



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Amit scores 19 or 17 points in round 3, as given in the above table. But the maximum number of points possible is 17. Thus, Amit scores 17 points in round 3 and 12 points in round 1.

Chatur has drawn a card with the maximum number on it in round 3, according to statement 3. The possible points for Chatur are 17, 16, 15 and 14. But Chatur can't score 17, 16 or 15 points as 17 and 15 are scored by Amit and Ben, and Chatur scores 16 in round 4. Thus, Chatur's score in round 4 is 14.

Hence, the final table becomes.

	Round 1	Round 2	Round 3	Round 4	Total Points	Rank
Amit	12	8	17	9	46	2
Ben	6	9	15	5	35	4
Chatur	15	7	14	16	52	1
Deepa	2/3	14	3/2	10	29	5
Eren	12	13	6	11	42	3

Chatur won 2 rounds, Amit 1 round and Deepa 1 round. Thus, the new total scores of Amit, Ben, Chatur, Deepa and Eren are 51 (46+5), 35, 62 (52+5+5), 34 (29+5) and 42, respectively.

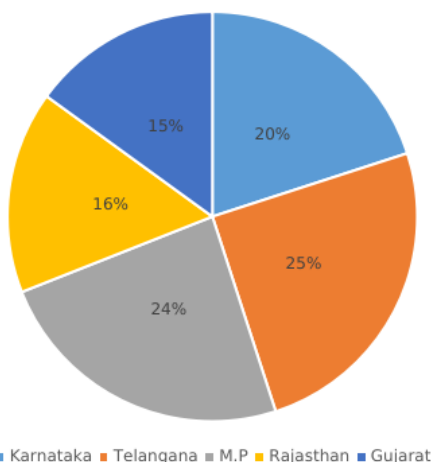
Thus, Deepa scored the lowest total points, so option A is the correct answer.

Instructions

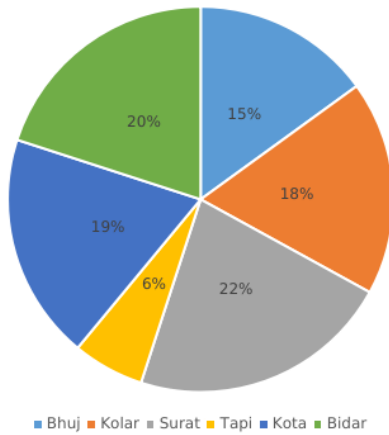
Aisha Foundation organized a yoga training program at Rishikesh. The only eligibility criteria to attend this program was one should be more than 21 years and less than 60 years of age. It is known that people have arrived only from the states Karnataka, Telangana, MP, Rajasthan and Gujarat. It is also known that people from Karnataka are only from the districts Bhuj, Kolar, Surat, Tapi, Kota and Bidar. All the people who arrived were eligible. The number of people who were less than 45 years is 75%.

The pie charts below represent the data of people who visited training programs from different states and those from the districts of Karnataka. The pie charts also depict only the data of people younger than 45 years. The number of people who arrived from Kolar who are less than 45 years is 162.

% Distribution among states



% Distribution among districts



41. How many members who attended the training program are from Rajasthan and are less than 45 years?

- A. 540
- B. 1080
- C. 360
- D. 720

Sol. Let the number of members who took part in the training program be 'T.'

The number of members who are part of the training program and are less than 45 years is $0.75T$. 20% of $0.75T$ are from Karnataka, and 18% of Karnataka people are from Kolar. It is given that number of people who arrived from Kolar and less than 45 years are 162 i.e. $0.18 \times 0.2 \times 0.75T = 162$ solving we get, $T = 6000$

Therefore, the number of members who are part of the training program and are less than 45 years is $0.75 \times 6000 = 4500$

State	Percentage	Number of members
Karnataka	20%	900
Telangana	25%	1125
M.P.	24%	1080
Gujarat	15%	675
Rajasthan	16%	720

Therefore, the number of members who are from Karnataka and are less than 45 years is 900.

District	Percentage	Number of members
Bhuj	15%	135
Kolar	18%	162
Surat	22%	198
Tapi	6%	54
Kota	19%	171
Bidar	20%	180



The number of members who attended from Rajasthan and are less than 45 years is 720. Therefore, the answer is option D.

42. How many members who attended training program are from Bhuj and are less than 45 years?

Sol. Let the number of members who took part in the training program be 'T.'

The number of members who are part of the training program and are less than 45 years is 0.75T. 20% of 0.75T are from Karnataka, and 18% of Karnataka people are from Kolar. It is given that number of people who arrived from Kolar and less than 45 years are 162 i.e. $0.18 \times 0.2 \times 0.75T = 162$ solving we get, $T = 6000$

Therefore, the number of members who are part of the training program and are less than 45 years is $0.75 \times 6000 = 4500$

State	Percentage	Number of members
Karnataka	20%	900
Telangana	25%	1125
M.P.	24%	1080
Gujarat	15%	675
Rajasthan	16%	720

Therefore, the number of members who are from Karnataka and are less than 45 years is 900.

District	Percentage	Number of members
Bhuj	15%	135
Kolar	18%	162
Surat	22%	198
Tapi	6%	54
Kota	19%	171
Bidar	20%	180

The number of members from Bhuj and less than 45 years is 135. Therefore, the answer is 135.

43. If the same data distribution of states and districts is also true for people who are greater than or equal to 45 years, by how much percent is the number of people who came from Bidar and are greater than or equal to 45 years is less than the number of people came from Karnataka and are less than 45 years?

- A. 91.67%
- B. 93.33%
- C. 80%
- D. 83.33%



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Sol. Let the number of members who took part in the training program be 'T.'

The number of members who are part of the training program and are less than 45 years is $0.75T$. 20% of $0.75T$ are from Karnataka, and 18% of Karnataka people are from Kolar. It is given that number of people who arrived from Kolar and less than 45 years are 162

$$\text{i.e. } 0.18 \times 0.2 \times 0.75T = 162$$

solving we get, $T = 6000$

Therefore, the number of members who are part of the training program and are less than 45 years is $0.75 \times 6000 = 4500$

State	Percentage	Number of members
Karnataka	20%	900
Telangana	25%	1125
M.P.	24%	1080
Gujarat	15%	675
Rajasthan	16%	720

Therefore, the number of members who are from Karnataka and are less than 45 years is 900.

District	Percentage	Number of members
Bhuj	15%	135
Kolar	18%	162
Surat	22%	198
Tapi	6%	54
Kota	19%	171
Bidar	20%	180

If the number of members attended the training program and is less than 45 years = x and the number of members attended the training program and is greater than or equal to 45 years = y , then $x : y = 3 : 1$. (as the number of people who are less than 45 years is 75% of total) Therefore, if sales data distribution of states and districts is true for the people who are greater than or equal to 45 years, then from all the states and districts, the number of people who attended the training program is greater than or equal to 45 years is always one-third the number of people who are less than 45 years.

The number of people came from Bidar and are greater than or equal to 45 years = $\frac{180}{3} = 60$

The number of people came from Karnataka and are less than 45 years = 900

$$\text{Required percentage} = \frac{840}{900} \times 100 = 93.33\%$$

The answer is option B.



44. Additional data: It is known that people from Gujarat have arrived from only Amreli, Patan and Jamnagar. Among all people who came from Gujarat, the ratio of people who have not arrived from Jamnagar to those who have not arrived from Amreli is 6:7, and the number of people those who have not arrived from Amreli is 40% greater than that of those who have not arrived from Patan.

If the same data distribution of states and districts as shown in pie charts is also true for the people who are greater than or equal to 45 years, what is the difference between the number of people who arrived from Jamnagar, and the number of people came from Gujarat and are greater than or equal to 45 years?

- A. 175
- B. 125
- C. 25
- D. 75

Sol. Let the number of members who took part in the training program be 'T.'
The number of members who are part of the training program and are less than 45 years is 0.75T. 20% of 0.75T are from Karnataka, and 18% of Karnataka people are from Kolar. It is given that number of people who arrived from Kolar and less than 45 years are 162
i.e. $0.18 \times 0.2 \times 0.75T = 162$
solving we get, $T = 6000$
Therefore, the number of members who are part of the training program and are less than 45 years is $0.75 \times 6000 = 4500$

State	Percentage	Number of members
Karnataka	20%	900
Telangana	25%	1125
M.P.	24%	1080
Gujarat	15%	675
Rajasthan	16%	720

Therefore, the number of members who are from Karnataka and are less than 45 years is 900.

District	Percentage	Number of members
Bhuj	15%	135
Kolar	18%	162
Surat	22%	198
Tapi	6%	54
Kota	19%	171
Bidar	20%	180

The number of people came from Gujarat = $0.15 \times 6000 = 900$

The number of people came from Gujarat and are greater than or equal to 45 years = $\frac{675}{3} = 225$

Let the number of people arrived from Amreli, Patan and Jamnagar be a, b and c respectively.

It is given that, $\frac{a+b}{b+c} = \frac{6}{7}$



$$7a + b = 6c \dots\dots (1)$$

$$b+c = \frac{7}{5}(a+c)$$

$$2c = 5b - 7a \dots\dots (2)$$

Solving (1) and (2), we get

$$a : b : c = 2 : 4 : 3$$

$$\text{The number of people from Jamnagar} = \frac{3}{9} \times 900 = 300$$

$$\text{Required difference} = 300 - 225 = 75$$

The answer is option D.

45. Let $f : \mathbb{R} \rightarrow \mathbb{R}$, $g : \mathbb{R} \rightarrow \mathbb{R}$, $h : \mathbb{R} \rightarrow \mathbb{R}$ be functions such that $f(x) = x^3 + 3x + 2$, $g(f(x)) = x$ and $h(g(x)) = x$ for all $x \in \mathbb{R}$. Then calculate the value of $h(0)$.

Sol. $h(g(x)) = x$ ----(i)

Replace x with $f(x)$ in equation (i)

$$h(g(f(x))) = f(x)$$

or, $h(g(x)) = f(x)$ (since $g(f(x)) = x$)

$$h(g(x)) = f(x) \text{ ---(ii)}$$

Replace x with $f(x)$ again in equation (ii)

$$h(g(f(x))) = f(f(x))$$

or, $h(x) = f(f(x))$ (since $g(f(x)) = x$)

Therefore, $h(x) = f(f(x))$

$$h(0) = f(f(0)), (f(0) = 2)$$

or, $h(0) = f(2) = 16$

46. From her home, Aparna reaches her office 30 minutes earlier than usual if she travels 25% faster than her usual speed. The distance between the mall and office is four times the distance between office and her home. If she is travelling 20% slower than usual, how much time will she take to go the mall from her office?

- A. 5 hrs
- B. 7.5 hrs
- C. 10 hrs
- D. 12.5 hrs

Sol. Let the original speed be 'v' and time taken to travel be 't'

It is given that, travelling with 25% more speed, she reached office 30 minutes early.



As distance is constant from home to office, we can write as

$$vt = \frac{5}{4}v \left(t - \frac{1}{2} \right)$$

$$t = \frac{5}{4}t - \frac{5}{8}$$

$$\frac{t}{4} = \frac{5}{8}$$

$$t = 2.5 \text{ hrs}$$

Time taken to travel from office to mall with original speed is $2.5 \times 4 = 10$ hrs (as distance is 4 times)

But it is told that speed is decreased by 20%, therefore time taken would $10 \times \frac{5}{4} = 12.5$ hrs

Answer is option D.

47. Ayra, Myra and Kiara invested in a business. Myra started investing Rs 6000 per month, after 4 months Ayra invested in business with Rs 6000 per month, later Kiara invested in business with Rs 12000 per month. After a year it is known that Myra received 50% of the profit. How many months after Ayra did Kiara invest?

- A. 1
- B. 3
- C. 6
- D. 2

Sol. Myra invested Rs 6000 per month in business for 12 months, hence her share = $12 \times 6000 + 11 \times 6000 + 10 \times 6000 + \dots + 1 \times 6000 = 78 \times 6000$

Ayra invested Rs 6000 per month in business for 8 months, hence her share = $8 \times 6000 + 7 \times 6000 + \dots + 1 \times 6000 = 36 \times 6000$

Let us assume Kiara invested in business for 't' months, hence her share = $12000 \times \frac{t(t+1)}{2} = t(t+1) \times 6000$

Myra received 50% of the profit which means she owns 50% share

$$78 \times 6000 + 36 \times 6000 + t(t+1) \times 6000 = 156 \times 6000$$

$$t(t+1) = 42$$

$$t = 6$$

This means Kiara invested after 6 months from starting of the business. Therefore, she invested 2 months after Ayra invested.

Answer is option D.

48. Find out the number of integer values of x such that $|(x + 1)(x + 3)(x + 5)| < 5$

Sol. Let $x + 3$ be y .

Hence,

$$|(y - 2) y (y + 2)| < 5$$

When $y = 2, 0, -2$, the absolute value is less than 5.

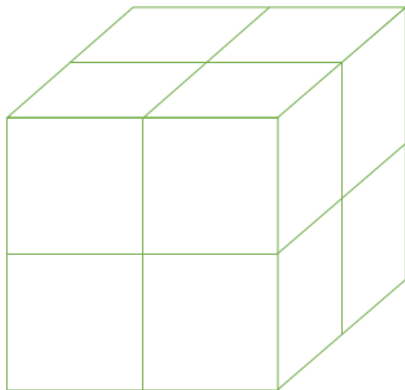
For the values $y = -1$ and $y = 1$, the absolute value is less than 5.

But for $y < -2$ and $y > 2$, the value of the expression is greater than 5.

Hence there are five possible values of y , and hence x .

49. A large cube is cut into n smaller cubes such that all n cubes have equal dimensions and no part of the larger cube remains. If the surface area increases by 4 times, what is the value of n ?

Sol. Since all the cubes are of the same dimensions, let us say that we are forming cubes that have half the length of the original cube. In that case, we need to have three mutually perpendicular cuts parallel to the faces of the cube.



In this case, the surface area becomes twice. because we are introducing one more set of surfaces.

Similarly, when we cut this into a cube such that the side of the smaller cubes is one-fifth of the side of the older cube, we increase the surface area by 4 times, or to five times, and we get 125 cubes.

50. A and B together can complete in 10 days. Had A increased its efficiency by 100% and and B decreased its efficiency by 50%, then it would take 8 days. How many days B alone would take to complete half of the work?

- A. 40
- B. 30
- C. 10
- D. 20



Sol. Let time taken by A to complete the work be 'x' and time taken by B to complete the work be 'y'

It is given that, $\frac{1}{x} + \frac{1}{y} = \frac{1}{10}$ (1)

A increases its efficiency by 100%, this means time taken by A to complete the work becomes half

B decreases its efficiency by 50%, this means time taken by B to complete the work becomes twice

$$\frac{2}{x} + \frac{1}{2y} = \frac{1}{8}$$
 (2)

Solving (1) and (2), we get

$$x = 20 \text{ and } y = 20$$

Time taken by B to complete the work = 20 days

Time taken by B to complete half of the work will be 10 days.

Therefore, answer is option C.

51. In a leap year, what is the probability that a day that starts with 'T' comes 53 times?

- A. 4/7
- B. 3/7
- C. 2/7
- D. 5/14

Sol. A leap year has only 2 days that appear more than 52 times. There are a total of seven cases.

The year starts on Monday. The additional days are M and T.

The year starts on Tuesday. The additional days are T and W.

The year starts on Wednesday. The additional days are W and T.

The year starts on Thursday. The additional days are T and F.

The year starts on Friday. The additional days are F and S.

The year starts on Saturday. The additional days are S and S.

The year starts on Sunday. The additional days are S and M.

$$P = 4/7.$$

52. If the minimum value of a quadratic expression $f(x) = x^2 + bx - c^2$ is obtained at $x = m$ [m is a constant], what is the sum of the roots of the equation $g(x) = 0$, where $g(x) = x^2 + (b + 2m)x - c^2$?

- A. 2c
- B. -2c
- C. c/2
- D. 0



Sol. $f(x) = x^2 + bx - c^2$

The minima is obtained at $x = -b/2a$, here $b = b$, $a = 1$

Hence, $m = -b/2$

$b = -2m$

Now,

$g(x) = x^2 + (b + 2m)x - c^2 = 0$

$x^2 - c^2 = 0$

$(x + c)(x - c) = 0$

Roots = $+c, -c$

Sum of roots = 0.

53. If one of the sides of a right triangle is 36 cm and the other two sides are in a ratio of 1:2 and the maximum possible area of the triangle [in cm^2] is $a\sqrt{b}$ [a and b are natural numbers], find out the minimum possible sum of a and b.

- A. 81
- B. 99
- C. 90
- D. 102

Sol. Let the other two sides be x and $2x$.

Now, x cannot be the largest side the hypotenuse.

Either $2x$ is the largest side or 36 is the largest side.

If $2x$ is the largest side, we get the maximum area.

Hence, area = $\frac{1}{2} \times 36 = 18x$

$x^2 + 36^2 = 4x^2$

$3x^2 = 36^2$

$x^2 = \frac{36^2}{3}$

$x = \frac{36}{\sqrt{3}} = 12\sqrt{3}$

Hence, area = $18 \times 12\sqrt{3} = 216\sqrt{3}$

Sum of $a + b = 219$.

We will try to reduce a and increase b .

Let us say that $a = 216/2 = 108$, $b = 3 \times 2 \times 2 = 12$. Sum = 120.

Let us say that $a = 216/3 = 72$, $b = 3 \times 3 \times 3 = 27$. Sum = 99.

Let us say that $a = 216/4 = 54$, $b = 4 \times 4 \times 3 = 48$. Sum = 102.

99 is the lowest possible sum. Any reduction in a will increase the sum.



54. In 2015, the ratio of the father's age to daughter's age was 5 : 2 and the ratio of the mother's age to father's age was 9 : 10. It is also known that the sum of the ages of the father and son was a prime number. Five years later, the average age of this four member family was 50. What is the sum of the ages of the son and daughter in 2022?

Assume that all the ages mentioned are natural numbers.

- A. 47
- B. 51
- C. 57
- D. 61

Sol. In 2015, let father's age be F, mother's age be M and daughter's age be D

It is given

$$F : D = 5 : 2 \text{ and } M : F = 9 : 10$$

we get, $F : M : D = 10 : 9 : 4$

father's age = $10x$, mother's age = $9x$, daughter's age = $4x$

Let son's age be 'y'

It is given $10x + y = z$ (z should be a prime number) (1)

It is also given 5 years later average age of the family is 50

$$10x + 9x + 4x + y + 20 = 200$$

$$23x + y = 180 \text{ (2)}$$

subtracting (1) from (2) we get

$$13x = 180 - z \text{ where } z \text{ is a prime number less than } 180$$

As 180 is in $13n+11$ form, z should be in $13n-2$ form

There are 4 prime numbers satisfying above conditions. They are 11, 37, 89 and 167.

For $z = 11$ and $z = 37$, you will get negative y value which is not possible.

For $z = 167$, you will get father's age is less than son's age which is not possible.

Therefore, only $z = 89$ satisfies both the equations.

$$13x = 180 - 89$$

$$13x = 91$$

$$x = 7$$

$$161 + y = 180$$

$$y = 19$$

In 2015, father's age = 70, mother's age = 63, daughter's age = 28 and son's age = 19

$$\text{Sum of daughter's age and son's age in 2022} = 28 + 7 + 19 + 7 = 61$$

Therefore, answer is option D.



55. If the number of factors of $(35^{35})^{35}$ that are divisible by 7^7 is $n(n-7)$, where n is a natural number, what is the value of n ?

- A. 1218
- B. 1223
- C. 1225
- D. 1226

Sol. $(35^{35})^{35} = 35^{35 \times 35} = 35^{1225} = 5^{1225} \times 7^{1225}$

Now for finding the factors of $(35^{35})^{35}$ that are divisible by 7^7 , we need to count the powers of 5 from 0 to 1225, and the powers of 7 from 7 to 1225.

Hence, the total number of factors = $(1225+1)(1225+1-7) = (1226)(1226-7)$

$n = 1226.$

56. A and B start from the same point and travel in opposite directions around a regular hexagon of side 30m. The ratio of their speeds is 2:3. What is the ratio of the total time taken by them to meet for the second time to the time taken by B to complete one round?

- A. 5:6
- B. 2:3
- C. 6:5
- D. 3:2

Sol. Length of total path = $30 \times 6 = 180$

Let the speed of A be 'x' and let the speed of B be 'y'

$x = \frac{2}{3}y$ (given A travels 2 sides when B travels 3 sides)

Time taken by B to complete 1 round = $\frac{180}{y}$

Time taken by A and B to meet for the first time = $\frac{180}{x+y} = \frac{180}{\frac{5y}{3}} = \frac{108}{y}$

Time taken by A and B to meet for the second time will be $\frac{216}{y}$

Ratio = $\frac{216}{y} : \frac{180}{y} = 6 : 5$

Therefore, answer is option C.



57. There are several books in a library out of which maths, social and science books are 10%, 40% and 50%. Out of all science books biology, physics and chemistry books are in the ratio 2 : 3 : 5. What percent of chemistry books are social books?

- A. 160%
- B. 150%
- C. 120%
- D. 180%

Sol. Let total number of books be T in library

$$\text{maths books} = 0.1T$$

$$\text{social books} = 0.4T$$

$$\text{science books} = 0.5T$$

$$\text{biology books} = \frac{2}{10} \times 0.5T = 0.1T$$

$$\text{physics books} = \frac{3}{10} \times 0.5T = 0.15T$$

$$\text{chemistry books} = \frac{5}{10} \times 0.5T = 0.25T$$

Let y percent of chemistry books are social books

$$\frac{y}{100} \times 0.25T = 0.40T$$

$$y = 160\%$$

Therefore, answer is option A.

58. If $\log a^x + \log b^x + \log c^x = \log d^x$ and $a:b = c:d$, find out the value of a. x is an odd multiple of 3. Enter -1 if it cannot be determined or multiple values exist.

Sol. $\log a^x + \log b^x + \log c^x = \log d^x$

$$x \log a + x \log b + x \log c = x \log d$$

$$x (\log a + \log b + \log c) = x \log d$$

$$x (\log abc) = x \log d$$

$$abc = d$$

Now, $a:b = c:d$

Hence, $\frac{a}{b} = \frac{c}{abc}$

$$\frac{a}{b} = \frac{1}{ab}$$

$$a^2 = 1$$

$$a = \pm 1$$

Now, we know that logarithms of negative numbers do not exist. Since x is odd, a^x is negative if $a = -1$. Hence $a = 1$.



59. A line that is parallel to $5x + 12y = 7$ and is at a distance of 2 units from it can pass through which of the following points?

- A. (5,3)
- B. (9,-1)
- C. (-3,-5)
- D. (3,1)

Sol. A line that is parallel to $5x + 12y = 7$ can be represented by

$$5x + 12y = c$$

Now, distance between these two lines

$$\frac{|7-c|}{\sqrt{5^2+12^2}} = 2$$

$$\frac{|7-c|}{13} = 2$$

$$|7 - c| = 26$$

$$7 - c = 26, 7 - c = -26$$

$$C = -19, c = 33$$

Hence, the new line is either

$$5x + 12y = -19 \text{ or } 5x + 12y = 33$$

Hence, only (9,-1) can lie on one of the lines.

60. Susan and Supriya wants to share the total amount Rs 5416 among them such that when deposited in a bank at 8% rate of interest compounded annually, Susan will have same amount after 3 years as Supriya will have after after 5 years. Approximately, what percent of total amount did Supriya receive?

- A. 45%
- B. 46%
- C. 47%
- D. 48%

Sol. Let Supriya's share be x, Susan's share will be $5416 - x$

$$x \left(1 + \frac{8}{100}\right)^5 = (5416 - x) \left(1 + \frac{8}{100}\right)^3$$

$$x \left(1 + \frac{8}{100}\right)^2 = 5416 - x$$

$$x \left(\left(\frac{54}{50}\right)^2 + 1\right) = 5416$$

$$x \cdot \frac{5416}{2500} = 5416$$

$$x = \text{Rs } 2500$$



Supriya's share = Rs 2500

$$\text{Required \%} = \frac{2500}{5416} \times 100 = 46\%$$

Therefore, answer is option B.

61. A shopkeeper wants to sell 6 books of cost Rs 30 each at a marked price of 50% more than cost price. But then due to lack of sales he starts giving successive discounts of x% twice after which the total selling price would be Rs X. Instead of giving successive discounts, if he had increased the price by x% twice (over the marked price), the total selling price would be Y. It is known that the difference between X and Y is Rs 432. What is the value of x?

- A. 40%
- B. 45%
- C. 25%
- D. 20%

Sol. Cost price of books = $30 \times 6 = \text{Rs } 180$

Marked price is $\frac{150}{100} \times 180 = \text{Rs } 270$

$$X = 270 \left(\frac{100-x}{100} \right)^2$$

$$Y = 270 \left(\frac{100+x}{100} \right)^2$$

It is given, $|X-Y| = 432$

$$270 \left(\frac{400x}{10000} \right) = 432$$

$$x = \frac{180}{270} \times 100 = 40\%$$

Answer is option A.

62. A can complete a job in 60 days working 3 hours a day. B can complete the job in 90 days working 5 hours a day. If working alone, A works for 3 hours in a day and B works 5 hours a day. If they work together they work for 5 hours each in a day. On the first day only A works, on the second day only B works and on the third day both of them work and this pattern continues till the job is done. How many days do they take to finish the job?

- A. 15
- B. 30
- C. 45
- D. 60

Sol. Let total work be 900 units



Work done by A in one hour $= \frac{900}{180} = 5$ units

Work done by B in one hour $= \frac{900}{450} = 2$ units

Work done on first day by A alone $= 5 \times 3 = 15$

Work done on second day by B alone $= 2 \times 5 = 10$

Work done on third day by both A and B $= 5(5+2) = 35$

Work done by both of them in 3 days $= 60$ units

Number of days required to finish the job $= \frac{900 \times 3}{60} = 45$ days

Therefore, answer is option C.

63. There are three solutions A, B and C with acid concentrations as 60%, 40% and 30% respectively. When 100 ml of A is mixed with x ml of B resultant acid concentration is 45% and when 100 ml of A is mixed with y ml of C resultant acid concentration is 40%. When y ml of B is mixed with x ml of C, what is acid concentration in resultant mixture?

A. 30%

B. 32%

C. 34%

D. 36%

Sol. $\frac{100(0.6) + x(0.4)}{(100 + x)} = 0.45$

solving we get $x = 300$ ml

$$\frac{100(0.6) + y(0.3)}{(100 + y)} = 0.4$$

solving we get $y = 200$ ml

$$\text{resultant concentration} = \frac{200(0.4) + 300(0.3)}{(200+300)} = \frac{170}{500} = 0.34$$

Resultant acid concentration = 34%

64. In a test, there are 100 questions. Each question that is correctly answered fetches +3 and a question that is wrongly answered fetches -2. Every question needs to be attempted. If the passing score is 40% of the maximum possible score in the test, how many questions need to be correct to get a score that is double the passing score?

Sol. Total possible score is $100 \times 3 = 300$

New passing score $= 2 \times 40\%$ of $300 = 240$

Now we can assign +3 to all questions and then subtract (+3 + 2) for each incorrect question.

Hence, if the number of incorrect questions is x,

$$300 - 5x = 240$$



$$5x = 60$$

$$x = 12$$

Hence, the number of correct questions = $100 - 12 = 88$.

65. If the absolute difference between the number of sides of a convex polygon and the number of diagonals is 168, what is the value of the sum of internal angles(in degrees)?

- A. 3420
- B. 3600
- C. 3780
- D. 3960

Sol. Let the number of sides be x .

Now,

$${}^x C^2 - x - x = 168$$

$$\frac{x(x-1)}{2} - x - x = 168$$

$$\frac{x^2-x}{2} - 2x = 168$$

$$x^2 - x - 4x = 336$$

$$x^2 - 5x - 336 = 0$$

Solving we get $x = 21$.

$$\text{The sum of internal angles} = (21 - 2)180 = 19 \times 180 = 3420$$

66. A four-digit number has to be formed using only prime digits such that any digit can come at most twice. How many of these numbers are divisible by 3?

Sol. Case 1: All digits are distinct.

In this case, the sum of digits = $2 + 3 + 5 + 7 = 17$. Hence, this is not divisible by 3.

Case 2: Two digits are the same, the other two digits are the same.

In this case, the sum of the digits = $2 * (x + y)$, where x and y are the distinct digits. This is possible only when x and y are 2 and 7 or 5 and 7.

Hence, the numbers are permutations of 2277 and 5577.

$$\text{Number of ways} = 2 * 4! / (2! * 2!) = 12.$$

Case 3: Two digits are the same, the other two are distinct.

In this case, the sum of the digits = $2x + y + z$. Here, x is repeated twice, and y and z are distinct.

Now, let us take all possible cases, and see how much it exceeds the nearest multiple of 3.

$$x = 2 \rightarrow 2x = 4 [+1]$$



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$$x = 3 \rightarrow 2x = 6 [+0]$$

$$x = 5 \rightarrow 2x = 10 [+1]$$

$$x = 7 \rightarrow 2x = 14 [+2]$$

Let us also take all possible cases for y and z.

$$2\ 3 \rightarrow 5 [+2]$$

$$2\ 5 \rightarrow 7 [+1]$$

$$2\ 7 \rightarrow 9 [+0]$$

$$3\ 5 \rightarrow 8 [+2]$$

$$3\ 7 \rightarrow 10 [+1]$$

$$5\ 7 \rightarrow 12 [+0]$$

We need the sum of the exceeding portions to be +0 or +3 to get a multiple of 3. Also, we need to see that there is no overlap between x and y/z.

$$22 [+1] \rightarrow 35 [+2]$$

$$33 [+0] \rightarrow 57 [+0], 27 [+0]$$

$$55 [+1] \rightarrow 23 [+2]$$

$$77 [+2] \rightarrow 25 [+1]$$

$$\text{Total number of cases} = 5 * (4!/2!) = 60$$

$$\text{Sum} = 72$$

