



DASH CAT 8

Instructions

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

Whether someone is trying to predict tomorrow's weather, forecast future stock prices, identify missed opportunities for sales in retail, or estimate a patient's risk of developing a disease, they will likely need to interpret time-series data, which are a collection of observations recorded over time. Making predictions using time-series data typically requires several data-processing steps and the use of complex machine-learning algorithms, which have such a steep learning curve they aren't readily accessible to non-experts. To make these powerful tools more user-friendly, MIT researchers developed a system that directly integrates prediction functionality on top of an existing time-series database. Their simplified interface, which they call tspDB (time series predict database), does all the complex modelling behind the scenes so a nonexpert can easily generate a prediction in only a few seconds.

The new system is more accurate and more efficient than state-of-the-art deep learning methods when performing two tasks: predicting future values and filling in missing data points. One reason tspDB is so successful is that it incorporates a novel time-series-prediction algorithm, explains electrical engineering and computer science (EECS) graduate student Abdullah Alomar, an author of a recent research paper in which he and his co-authors describe the algorithm. This algorithm is especially effective at making predictions on multivariate time-series data, which are data that have more than one time-dependent variable. In a weather database, for instance, temperature, dew point, and cloud cover each depend on their past values. The algorithm also estimates the volatility of a multivariate time series to provide the user with a confidence level for its predictions.

"Even as the time-series data becomes more and more complex, this algorithm can effectively capture any time-series structure out there. It feels like we have found the right lens to look at the model complexity of time-series data," says senior author Devavrat Shah, the Andrew and Erna Viterbi Professor in EECS...Shah and his collaborators have been working on the problem of interpreting time-series data for years, adapting different algorithms and integrating them into tspDB as they built the interface.

About four years ago, they learned about a particularly powerful classical algorithm, called singular spectrum analysis (SSA), that imputes and forecasts single time series. Imputation is the process of replacing missing values or correcting past values. While this algorithm required manual parameter selection, the researchers suspected it could enable their interface to make effective predictions using time series data. In earlier work, they removed this need to manually intervene for algorithmic implementation. The algorithm for single time series transformed it into a matrix and utilized matrix estimation procedures. The key intellectual challenge was how to adapt it to utilize multiple time series. After a few years of struggle, they realized the answer was something very simple: "Stack" the matrices for each individual time series, treat it as a one big matrix and then apply the single time-series algorithm on it.

They tested the adapted SSA against other state-of-the-art algorithms, including deep-learning methods, on real-world time-series datasets with inputs drawn from the electricity grid, traffic patterns, and financial markets. Their algorithm outperformed all the others on imputation, and it outperformed all but one of the other algorithms when it came to forecasting future



values...The impressive performance of SSA is what makes tspDB so effective, Shah explains. Now, their goal is to make this algorithm accessible to everyone.

1. The utility of machine learning algorithms that make predictions using time-series data is presented under the assumption that

- A. such predictions are desired and inherently valuable.
- B. the usage of machine learning algorithms for making predictions is limited to experts.
- C. such algorithms can immensely modify the way in which current technology works.
- D. a reduction in the complexity of algorithms to make predictions might be feasible.

Sol. "Whether someone is trying to predict tomorrow's weather, forecast future stock prices, identify missed opportunities for sales in retail, or estimate a patient's risk of developing a disease, they will likely need to interpret time-series data, which are a collection of observations recorded over time. Making predictions using time-series data typically requires several data-processing steps and the use of complex machine-learning algorithms, which have such a steep learning curve they aren't readily accessible to non-experts. "

The points stated in the underlined segment all emphasise that such predictions hold some inherent value; if this were not the case, making predictions and deliberating on the kind of algorithms that facilitate such predictions would not make sense. We can discern that there is some benefit to be drawn from these predictions, which is why the discussed algorithm/system (tspDB) is significant or worth noting. Option A correctly captures the premise.

Options C and D are not implied or relevant to the discussion, while Option B is the premise for highlighting the utility of tspDB.

Hence, Option A is the correct choice.

2. tspDB makes better predictions than others when both use the same type of data. Which of the following is likely to be the data type?

- A. Scores of school students who have graduated from a particular school for the past 100 years.
- B. The past criminal record of a person suspected of robbery.
- C. The performance of an athlete in each major event of the past 2 years.
- D. Data about the salinity and the pollution levels in a river for the past month.

Sol. This algorithm is especially effective at making predictions on multivariate time-series data, which are data that have more than one time-dependent variable. In a weather database, for instance, temperature, dew point, and cloud cover each depend on their past values. The algorithm also estimates the volatility of a multivariate time series to provide the user with a confidence level for its predictions.

The passage suggests that tspDB is more proficient at handling multiple variables that change with time.

Options A, B, and C deal with data that include only one variable. Option D deals with more than one, thus is a multivariable dataset. Hence, Option D is the correct answer.



3. Which of the following, if true, greatly weakens the outcome of the research?

- A. Despite using the stacked-SSA to create a single matrix for applying the time series algorithms, the parameter selection needs to be done manually by the user.
- B. Few state-of-the-art algorithms can outperform the tspDB system when it comes to both imputation and predicting future outcomes.
- C. Using the tspDB system to make relevant predictions requires computational and statistical expertise alongside a deep understanding of correctly categorising multivariate data.
- D. The volatility associated with the time-series predictions makes the tspDB system unsuitable for certain specific applications in the military and healthcare domain.

Sol. {Their simplified interface, which they call tspDB (time series predict database), does all the complex modelling behind the scenes so a nonexpert can easily generate a prediction in only a few seconds} ... { Now, their goal is to make this algorithm accessible to everyone. }

One of the main objectives of the research is to make the algorithm's predictive power more accessible to 'non-experts'. Option C attacks this idea and hence, weakens the outcome of the research. If it requires expertise of some form, the intention behind undertaking the project is undermined. Hence, Option C is the correct choice.

Both Options A and D do very little to undermine the utility of the research and thus, can be rejected. Option B has been presented to be an acceptable outcome. [even if it were true, it does not discount the fact that the tspDB system can be used by non-experts]

4. All of the following is true about tspDB EXCEPT:

- A. Even when facing increasingly complex time-series data, the tspDB algorithms remains effective.
- B. tspDB has relatively higher accuracy and efficiency in terms of imputations and predictions compared to other deep-learning systems.
- C. tspDB can be used by non-experts as a functional overlay on their existing time-series database to make predictions swiftly.
- D. The tspDB system algorithm presents an estimated level of accuracy for the predictions by measuring the volatility of the time-series data.

Sol. Option A: The statement here has been presented in the passage: "...Even as the time-series data becomes more and more complex, this algorithm can effectively capture any time-series structure out there. It feels like we have found the right lens to look at the model complexity of time-series data..."

Option B: This has been explicitly mentioned in the passage: "...The new system is more accurate and more efficient than state-of-the-art deep learning methods when performing two tasks: predicting future values and filling in missing data points. One reason tspDB is so successful is that it incorporates a novel time-series-prediction algorithm..."

Option C: The following excerpt highlights this point: "...MIT researchers developed a system that directly integrates prediction functionality on top of an existing time-series database. Their simplified interface, which they call tspDB (time series predict database), does all the complex



modelling behind the scenes so a nonexpert can easily generate a prediction in only a few seconds...”

Option D: There is a slight distortion in the option: “...The algorithm also estimates the volatility of a multivariate time series to provide the user with a confidence level for its predictions...” We cannot definitively equate confidence level to accuracy level.

Hence, Option D is the correct choice.

Instructions

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

12 Angry Men is earnest, sincere, and 60 years old today—an admirable if slightly stale product of its time. But Donald Trump’s presidency—and his assault on the basic liberal value of justice—have lent the film a new relevance. What once felt creaky and old-fashioned now burns bright with fresh outrage—and serves as a disconcerting reminder of our own regression.

The 12 ordinary (white) men who congregate in Sidney Lumet’s film have been given the God-like power of determining the ultimate fate of teenage street kid—a minority accused of murdering his father. Their leader, initially, is Juror No. 3—a sour, authoritarian bully played by Lee J. Cobb, who is ready, even eager to send the boy to die. Then Henry Fonda enters as bleeding-heart Juror No. 8, who—in what can only be deemed an outrageous fantasy—uses logic and facts to convince a group of skeptical, angry strangers to agree with him.

Cobb’s sharply drawn antagonist at least has a legal obligation to mask the rage and racism behind his desire to execute a poor kid. Trump, meanwhile, didn’t even need to be on the jury of the notorious 1989 Central Park 5 case—in which five black teenagers were falsely accused of raping and beating a wealthy white jogger—to determine that the defendants were guilty. Now a president who backs measures like a Muslim immigration ban, Trump has broadened the conversation around race in this country to empower the Juror No. 3s of the world. Like Cobb’s villain, Trump’s primary motivation often seems to be a sour, unshakable conviction that a non-white person accused of something is almost assuredly guilty—and that we, as white people, owe it to “real Americans” (i.e, other white people) to punish them.

At first, Fonda’s impassioned liberal faces an uphill battle, as impassioned liberals often do. But his character keeps picking away at the state’s case, to Cobb’s increasing rage. The pressure of deciding a man’s fate reveals the jurors’ true character, particularly in the case of Juror No. 10 (Ed Begley)—who apoplectically condemns the accused not on the facts of the trial, but his sour, hateful certainty about the true nature of “them.” When the racist juror angrily insists, “I’m sick and tired of facts,” he could be Kellyanne Conway.

The juror appeals to the other white men on the basis of racial resentment, saying that bad behavior “is born in” that nebulous “them.” The more worked up he gets, the more repulsive his words sound—and the more his fellow jurors reject both his argument and his entire worldview. Gradually, they stand and literally turn their backs on No. 10. It’s a touching scene, and more than a little heartbreaking in the context of 2017—where our own Juror No. 10 was rewarded with the highest position in the land.

Yes, it’s depressing that ordinary white men from a black-and-white film released more than a half century ago have a more nuanced and progressive attitude toward racism than the majority



of voters in 2016—in a handful of swing states, anyway. But the passionate conviction of 12 Angry Men is inspiring as well. After all, when Trump defied the legal system with his Muslim ban, the American public did not march in lockstep behind him. Instead, many turned their backs on Trump, metaphorically speaking—then took to the streets.

5. The author terms part of the plotline involving Henry Fonda's Juror 8 an "outrageous fantasy" because

- A. such characters are only possible in fantasy movies and not in real life.
- B. facts are rarely used in a similar discourse today, and objective arguments seldom convince people.
- C. people are increasingly sentimental and can not be made to agree to a viewpoint using logic and facts only.
- D. movies generally exaggerate real life by showcasing ideal situations to provide entertainment.

Sol. Then Henry Fonda enters as bleeding-heart Juror No. 8, who—in what can only be deemed an outrageous fantasy—uses logic and facts to convince a group of skeptical, angry strangers to agree with him.

The author writes this passage to highlight what he considers an assault on democracy in present times. He exemplifies this using an evergreen movie, where a discourse seems otherworldly as the traits exhibited by the participants (the Jurors) during the discussion would be absent today in a similar discussion. It is emphasised that people are rarely convinced by objective arguments today. Option B is the correct answer.

The other options point toward different viewpoints, which are not in line with the one presented above.

6. Parallels have been drawn between various characters and aspects of the film and real-world people and events. Which of the following is NOT a parallel drawn by the author?

- A. Henry Fonda's impassioned Juror no. 8 and the American public that took to the streets to protest the Muslim ban.
- B. Trump's stance in the 1989 Central Park 5 case and Juror 3's condemnation of the teenage street kid as guilty.
- C. Juror 3's worldview and Donald Trump's conviction that a non-white person accused of something is almost assuredly guilty.
- D. Racist Juror 10 ignoring facts and the similar proclivity shown by Kellyanne Conway.

Sol. Option A: The author does not liken Fonda's Juror 8 to the American public. While we are told that Juror 8 utilised objective arguments to convince the other jurors, we cannot glean the similarity with the decision of the American masses to protest the Muslim ban. Instead, a parallel is drawn between the action of the jurors to turn their back on Juror 10's worldview and the protest by Americans against Trump's Muslim ban.



Option B: This parallel is drawn in the following excerpt: {Cobb’s sharply drawn antagonist at least has a legal obligation to mask the rage and racism behind his desire to execute a poor kid. Trump, meanwhile, didn’t even need to be on the jury of the notorious 1989 Central Park 5 case—in which five black teenagers were falsely accused of raping and beating a wealthy white jogger—to determine that the defendants were guilty.}

Option C: This parallel is drawn in the following excerpt: {Now a president who backs measures like a Muslim immigration ban, Trump has broadened the conversation around race in this country to empower the Juror No. 3s of the world. Like Cobb’s villain, Trump’s primary motivation often seems to be a sour, unshakable conviction that a non-white person accused of something is almost assuredly guilty—and that we, as white people, owe it to “real Americans” (i.e, other white people) to punish them.}

Option D: This parallel is drawn in the following excerpt: {When the racist juror angrily insists, “I’m sick and tired of facts,” he could be Kellyanne Conway.}

Hence, Option A is the correct choice.

7. The author cites the fate of Juror 10 to

- A. emphasise the need for basing beliefs on facts - using emotions instead of logic to create a worldview will always backfire and lead to public censure.
- B. contrast the outcome with reality - while the other jurors in the film stood up and rejected Juror 10’s worldview, many Americans in the present espouse it.
- C. emphasise the importance of standing up to racism - while the other jurors in the film ostracised Juror 10, many Americans failed to publicly call out Trump's racism.
- D. highlight how this is a heartbreaking fantasy - since the majority of Americans continue to support Juror 10’s racist worldview.

Sol. “Gradually, they stand and literally turn their backs on No. 10. It’s a touching scene, and more than a little heartbreaking in the context of 2017—where our own Juror No. 10 was rewarded with the highest position in the land.”

The author showcases the contrast between the outcome in the film and the reality in America. While other jurors shunned Juror 10's racist worldview, present-day Americans allowed a person with a similar worldview to get elected as the president. This is indicative of how Americans espouse such a detrimental worldview. Option B correctly captures this.

The need to base beliefs on facts is not the idea being touched upon; hence, option A can be eliminated. We cannot identify if 'the majority of Americans continue to support Juror 10’s racist worldview'; while we know that many Americans have fallen prey to such racist beliefs, we cannot extend it to the majority. Hence, Option D is incorrect. The author is ruling the fact that people hold the same racist views as Trump and not that they haven't publicly called him out. Hence, C is also incorrect.



8. The author will most likely disagree with which of the following?

- A. Compared to the circumstances in the movie 12 Angry Men and the more progressive attitude of some of the jurors towards racism, the current state of affairs in America appears nothing short of a regression.
- B. Our choice of elected representatives in the recent past somewhat establishes the fact that individuals who echo the same sentiments as that of Juror 3 and Juror 10 have become pervasive.
- C. Constant exposure to skewed, racist arguments and worldviews of elected officials has led the American public to reject such detrimental beliefs and turn their back on politics.
- D. Recent responses of the American public to contentious policies by the government reflect the passionate conviction showcased by the protagonists in 12 Angry Men.

Sol. Option A: The author will agree with this comment: "Yes, it's depressing that ordinary white men from a black-and-white film released more than a half century ago have a more nuanced and progressive attitude toward racism than the majority of voters in 2016—in a handful of swing states, anyway."

Option B: The claim here would resonate with the author since he does not appear happy about some of our recent choice of elected representatives. This is quite evident when he compares Donald Trump and Kellyanne Conway to Jurors 3 and 10 from the film.

Option C: The author labels the present society as a 'regression'. He might not agree with people rejecting racism; instead, people who support such a racist worldview, as shown in the film, pervade the public domain, according to him. Moreover, no mention is made about turning their backs on politics. Hence, Option C is the correct choice.

Option D: The statement here aligns with the following: "But the passionate conviction of 12 Angry Men is inspiring as well. After all, when Trump defied the legal system with his Muslim ban, the American public did not march in lockstep behind him. Instead, many turned their backs on Trump, metaphorically speaking—then took to the streets."

Instructions

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

Toward the end of the 19th century, lurid tales of killer plants began popping up everywhere. Terrible, tentacle-waving trees snatched and swallowed unwary travellers in far-off lands. Mad professors raised monstrous sundews and pitcher plants on raw steak until their ravenous creations turned and ate them too. The young Arthur Conan Doyle stuck closer to the science in a yarn featuring everyone's favourite flesh-eater, the Venus flytrap. Drawing on brand-new botanical revelations, he accurately described the two-lobed traps, the way they captured insects, and how thoroughly they digested their prey. But even his flytraps were improbably large, big enough to entomb and consume a human. Meat-eating, man-eating plants were having a moment, and for that, you can thank Charles Darwin.

Until Darwin's day, most people refused to believe that plants ate animals. It was against the natural order of things. Mobile animals did the eating; plants were food and couldn't move —



if they killed, it must only be in self-defence or by accident. Darwin spent 16 years performing meticulous experiments that proved otherwise. He showed that the leaves of some plants had been transformed into ingenious structures that not only trapped insects and other small creatures but also digested them and absorbed the nutrients released from their corpses. In 1875, Darwin published *Insectivorous Plants*, detailing all he had discovered. In 1880, he published another myth-busting book, *The Power of Movement in Plants*. The realization that plants could move as well as kill inspired not just a hugely popular genre of horror stories but also generations of biologists eager to understand plants with such unlikely habits.

[...]There's no evidence that carnivorous plants acquired any of their beastly habits by hijacking genes from their animal victims, says biophysicist Rainer Hedrich, although genes do sometimes pass from one type of organism to another. Instead, a slew of recent findings points to the co-option and repurposing of existing genes that have age-old functions ubiquitous among flowering plants[...]Quirky though it is, carnivory has evolved repeatedly over the 140 million-plus years that flowering plants have been around. The adaptation arose independently at least 12 times, says Tanya Renner, an evolutionary biologist at Penn State.

Each time, the driving force for evolution was the same: the need to find an alternative source of vital nutrients. Carnivorous plants grow in swamps and bogs, in nutrient-poor bodies of water or on thin tropical soils, all habitats short on the nitrogen and phosphorus essential for growth. Protein-packed insects and other small invertebrates are rich sources of both, as well as other elements plants need to flourish. "A Venus flytrap can live for three weeks on a single large insect," says Hedrich. "If it captures lots of insects, it produces more leaves and more traps."

Today there are some 800 known carnivorous species. Some, like pitcher plants and many sundews, are passive receivers of prey — albeit with ingenious adaptations such as slippery rims and gluey-tipped hairs that help to secure a meal. Others are more active: Some sundews curl inward, nudging prey into the trap's stickier centre, while a few have an outer ring of fast-moving tentacles that hurl victims to their doom. Most sophisticated of all is the Venus flytrap, *Dionaea muscipula*, with its sensitive trigger hairs and snap-traps that can distinguish the touch of an insect from a falling raindrop or dead leaf and can judge the size of the prey and respond accordingly.

9. The tales of carnivorous plants have been cited in the first paragraph:

- A. to highlight the interest in the subject that was generated by the discovery of carnivory in plants.
- B. to show how disillusioned the general populace was about the subject.
- C. to show that such tales had a major impact in bringing the topic to the forefront and inspiring biologists.
- D. to show how far off the public was from the scientific aspect of things at that time.

Sol. Toward the end of the 19th century, lurid tales of killer plants began popping up everywhere.....Meat-eating, man-eating plants were having a moment, and for that, you can thank Charles Darwin.

The first paragraph introduces the moment that the carnivorous and hyped-up 'man-eating' plants were having, thanks to Charles Darwin and his groundbreaking research on the matter. Hence, examples have been given to show how the subject generated much interest after Darwin presented irrefutable evidence of the same. Hence, Option A is the correct answer.



The examples were not a cause but a consequence of the study. Also, Darwin's discovery, not the horror stories, has been credited with inspiring biologists. Hence, Option C is a distortion.

The examples have not been presented to show the understanding of the people but to show the prominence the subject had gained at that time. Options B and D can be eliminated too.

10. Which of the following is true as per the passage?

- A. Even though there was a plethora of fictional tales about carnivorous plants, only Arthur Conan Doyle presented a scientifically accurate representation of one such plant in his stories.
- B. Horror stories featuring dreadful carnivorous plants did not exist before Darwin published *Insectivorous Plants* in 1875 and *The Power of Movement in Plants* in 1880.
- C. Akin to all other carnivorous plants, the Venus Fly Trap grows in swamps and bogs that are deficient in nitrogen and phosphorous and sustains itself solely on insects.
- D. The disbelief in carnivory among plants before Darwin's work can be best attributed to the perception that plants were immobile and incapable of killing other organisms.

Sol. Option A: The statement here is false based on the following: "...The young Arthur Conan Doyle stuck closer to the science in a yarn featuring everyone's favourite flesh-eater, the Venus flytrap. Drawing on brand-new botanical revelations, he accurately described the two-lobed traps, the way they captured insects, and how thoroughly they digested their prey. But even his flytraps were improbably large, big enough to entomb and consume a human..." Thus, Conan Doyle's plant was not scientifically accurate in terms of size.

Option B: We cannot conclusively comment on the validity of this statement. It's possible that while such horror stories could have existed, they might not have been popular or widely circulated.

Option C: While carnivorous plants do grow in environments deficient in nitrogen and phosphorous, we cannot deduce whether Venus Fly Trap grows specifically in swamps and bogs. Additionally, generalising this to all carnivorous plants would be incorrect.

Option D: The statement here is true based on the following: "...Until Darwin's day, most people refused to believe that plants ate animals. It was against the natural order of things. Mobile animals did the eating; plants were food and couldn't move — if they killed, it must only be in self-defence or by accident..."

Hence, Option D is the correct choice.

11. The current notion on the origin of carnivorous plants agrees with which of the following?

- I: Carnivory stemmed as an adaptation independently in flowering plants, owing to unfavourable environmental conditions that created pressure to survive in nutrient-sparse habitats.
- II: Over the span of millions of years, flowering plants remodelled some of their genes to function differently, leading to carnivory.
- III: Genes from the prey could have been incorporated, leading the plants to consequently evolve their mechanisms over time.



- A. only I
- B. only II and III
- C. only I and II
- D. I, II and III

Sol. I: The author talks about survival pressure in the penultimate paragraph: “Each time, the driving force for evolution was the same: the need to find an alternative source of vital nutrients. Carnivorous plants grow in swamps and bogs, in nutrient-poor bodies of water or on thin tropical soils, all habitats short on the nitrogen and phosphorus essential for growth” Hence, Statement I is correct.

II & III: Statement III is rejected by biophysicist Rainer Hedrich due to lack of evidence, while 'repurposing' of genes is explicitly stated in the following: “There’s no evidence that carnivorous plants acquired any of their beastly habits by hijacking genes from their animal victims, says biophysicist Rainer Hedrich, although genes do sometimes pass from one type of organism to another. Instead, a slew of recent findings points to the co-option and repurposing of existing genes that have age-old functions ubiquitous among flowering plants”

Therefore, statements I and II are true, while statement III is invalid. Hence, the correct answer is Option C.

12. The difference between active and passive carnivorous plants as mentioned in the passage is that:

- A. The former depends only on movement, while the latter depends on other means to secure the prey.
- B. The former can entrap prey that is not in its immediate proximity, while the latter cannot do so.
- C. The former entrap prey using movement while the latter depends on the prey to stumble on the plant's trap.
- D. The former uses moving traps while the latter uses sticky digestive juices to entrap the insect.

Sol. Some, like pitcher plants and many sundews, are passive receivers of prey — albeit with ingenious adaptations such as slippery rims and gluey-tipped hairs that help to secure a meal. Others are more active: Some sundews curl inward, nudging prey into the trap’s stickier centre, while a few have an outer ring of fast-moving tentacles that hurl victims to their doom.

In the above excerpt, the author has distinguished the two kinds of carnivorous plants. The passive ones are receivers, where the slippery rims and gluey-tipped hairs entrap prey that stumbles upon them. On the other hand, the active ones use movement to nudge the prey towards the digestion site. Option C comes the closest to capturing this and hence, is the correct answer.

- A: We cannot say that the active ones depend only on movement and nothing else.
- B: It has not been mentioned that the active ones move from one location to the other, but their body parts move in a manner to entrap the insect. Thus, their reach is only to the insects that are in their proximity.



D: Though true, not an apt differentiation because the scope of passive carnivorous plants has only been limited to sticky digestive juices.

Instructions

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

I happen to live a stone's throw from the former Holloway women's prison. At our National Childbirth Trust class, the course leader, reflecting on years of work in the community, told us how keen most women are to leave hospital as soon as possible after giving birth, with the exception of the women from the prison, who wanted to stay as long as possible to delay returning to prison mother-and-baby units, where after 18 months their baby would be taken away from them. This continues to be the fate of women in prisons across the UK.

Eleven countries including Russia, Brazil, Mexico, Italy and Portugal, have laws against the imprisonment of pregnant women, but not the UK, despite the fact that more than three in five women enter prisons for sentences of less than six months. The feminist organisation Level Up, along with the groups Women in Prison, No Births Behind Bars and others - including midwives, doctors and solicitors - are campaigning to change that.

“Non-punitive responses to women who are traumatised and often in poverty and need support are what we should be striving for, rather than just exacerbating their existing trauma and poverty in prison, and then sometimes taking their children to care,” says Level Up campaigner Janey Starling. At present six out of 10 women in prison are survivors of domestic abuse.

This campaign isn't just about the risks of already traumatised women being forced to potentially endure the trauma of labour behind bars, it is also about prison being an unsafe place for any woman at any stage of pregnancy. Writing under a pseudonym in this newspaper, “Anna”, told of how she was too afraid to leave her cell in case a fight broke out and put her baby at risk, how the food was so unhealthy that it made her sick. She was handcuffed during labour, having waited hours to be taken to hospital. Guards refused to phone her mother or partner and watched her while she laboured. The doctor present was disgusted with her treatment. Other women have spoken of being denied extra food even when they are suffering morning sickness, and of being forced to miss scans or wait for them even when fearing miscarriage.

The treatment of these women is inhumane. As for their babies, to be born into incarceration is a children's rights issue. “We know that the first 24 months of a child's life are the building blocks for their future and whatever they experience will impact their development, will impact their attachment with the mother,” says Starling. A “short sentence” for a woman is, she points out, a long sentence for her baby, and a lifetime in terms of trauma.

In a reflection of its “tough on crime” stance, the government has been resistant to change its policy on the incarceration of pregnant women. Though the Ministry of Justice is keen to emphasise the rarity of cases such as stillbirth and miscarriage among incarcerated women, there is a lack of transparency and data, both in terms of how many pregnant women are incarcerated and what their pregnancy outcomes - whether miscarriage or stillbirth - are.



13. The author is bound to agree with all of the following EXCEPT:

- A. Women prisoners desire to stay longer in hospitals after childbirth due to the deplorable conditions awaiting them and their children in prison units.
- B. Most people campaigning against the incarceration of pregnant women will agree that subjecting women to harsher conditions in prison exacerbates their trauma drastically.
- C. Policies allowing for the establishment of rehabilitation centres instead of incarcerating pregnant women should be a pressing priority in the UK.
- D. Miscarriages and stillbirths in prison can be mainly attributed to the inhumane treatment of pregnant women at the hands of ignorant guards.

Sol. Option A: Given the author's tone in the passage, he will agree with this point since the reluctance to go back is presented in the first paragraph.

Option B: This statement echoes the author's discussion on how incarceration would worsen the trauma and poverty of women in prison.

Option C: {...Eleven countries including Russia, Brazil, Mexico, Italy and Portugal, have laws against the imprisonment of pregnant women, but not the UK, despite the fact that more than three in five women enter prisons for sentences of less than six months...“Non-punitive responses to women who are traumatised and often in poverty and need support are what we should be striving for, rather than just exacerbating their existing trauma and poverty in prison, and then sometimes taking their children to care,” says Level Up campaigner Janey Starling...}

The author mentions how the UK lacks laws preventing the incarceration of pregnant women. He also cites Janey Starling's advocacy for non-punitive measures. Given the author's tone in the passage, he is bound to agree that policies allowing for establishing rehabilitation centres instead of incarcerating pregnant women should be a pressing priority in the UK.

Option D: The assertion here is quite extreme; it is unclear if the author agrees with the statement. While a large chunk of the cases could be attributed to the harsh treatment of pregnant women, there could be other reasons that need to be factored in for the remaining number of the cases. The sub-standard healthcare facilities could also be to blame. Hence, attributing it to one factor would be incorrect.

Hence, Option D is the correct choice.

14. Which of the following statements, if true, would most weaken the case presented by Level Up?

- A. In countries with no incarceration for pregnant women, some crime syndicates intentionally employ pregnant women for illegal activities like drug peddling.
- B. The psychological trauma and financial strain faced by women prisoners leaves them ineligible to take care of their children and consequently, has been a cause of recidivism.
- C. Non-punitive stance toward one faction of the society could elicit a strong response for policy changes implementing a comparable treatment towards other similarly affected groups.
- D. State programs in the UK allow women prisoners to obtain an early release on the grounds of good behaviour to reconcile with their children and to get employed by the authorities.



Sol. “Non-punitive responses to women who are traumatised and often in poverty and need support are what we should be striving for, rather than just exacerbating their existing trauma and poverty in prison, and then sometimes taking their children to care,” says Level Up campaigner Janey Starling.

From the above excerpt, we can see that Level Up argues for non-punitive measures for poor and traumatized women again. The option that attacks the benefits it presents or highlights a dangerous consequence it could present will be the correct answer.

Option A shows that if the punitive measures were removed, crimes involving pregnant women would rise dramatically. Furthermore, it completely counters the positive prospects of non-punitive measures; hence, Option A is the correct answer.

Option B: The claim here doesn't affect the need for non-punitive measures. If anything, it reinforces the requirement of rehabilitation for women prisoners. Hence, B can be eliminated.

Option C: The claim here does not discount the need for non-punitive responses. Whether for one group or many similarly affected groups, the government must deliberate and develop policies to alleviate the issue. Thus, the argument here is weak and can be rejected.

Option D: While early release might be a favourable option, the damage is already done. The author emphasises how the women prisoners are at their most vulnerable when incarcerated while pregnant; additionally, the children born into incarceration experience lifelong trauma. Level Up is protesting against this very setup by advocating for non-punitive measures; Option D does very little to weaken the case they presented.

Hence, Option A is the correct choice.

15. The main objective of the third-last paragraph is to:

- A. argue for better living conditions inside a prison containing pregnant women.
- B. paint a picture of the terrible conditions pregnant women go through when incarcerated.
- C. draw a narrative around the evils of incarceration and how it changes people.
- D. to illustrate how prisons are not a safe place for pregnant women.

Sol. This campaign isn't just about the risks of already traumatised women being forced to potentially endure the trauma of labour behind bars, it is also about prison being an unsafe place for any woman at any stage of pregnancy. Writing under a pseudonym in this newspaper, “Anna”, told of how she was too afraid to leave her cell in case a fight broke out and put her baby at risk, how the food was so unhealthy that it made her sick. She was handcuffed during labour, having waited hours to be taken to hospital. Guards refused to phone her mother or partner and watched her while she laboured. The doctor present was disgusted with her treatment. Other women have spoken of being denied extra food even when they are suffering morning sickness, and of being forced to miss scans or wait for them even when fearing miscarriage.

The above paragraph is an extension of the author's argument to avoid the incarceration of pregnant women. Here, he tries to paint a picture of all that a woman in prison has to go through during her pregnancy and childbirth. Option B is the correct answer.



Option A comes close. The author, however, is not advocating for better facilities but completely stopping the incarceration of pregnant women. Option A can be eliminated for this reason.

Option C talks about general incarceration evils, which are not specific to pregnant women in prisons and thus can be eliminated.

Option D is incomplete and insufficient in describing the point of the paragraph. The point is about how terribly pregnant women are treated in prisons and during their delivery. Thus, option D can be eliminated.

16. Which of the following is in line with the opinion of the Ministry of Justice on the matter discussed in the passage?

- A. There is a lack of data about the conditions experienced by women in prisons without which a decision cannot be taken.
- B. All the data suggests that pregnant women in prisons rarely suffer from stillbirth and miscarriages.
- C. The inhumane treatment of pregnant women in prison is rare, and their incarceration is justified.
- D. The government must be tough on crime but at the same time reconsider the incarceration of pregnant women.

Sol. In a reflection of its “tough on crime” stance, the government has been resistant to change its policy on the incarceration of pregnant women. Though the Ministry of Justice is keen to emphasise the rarity of cases such as stillbirth and miscarriage among incarcerated women, there is a lack of transparency and data, both in terms of how many pregnant women are incarcerated and what their pregnancy outcomes - whether miscarriage or stillbirth - are.

The above excerpt shows that the Ministry of Justice, as an extension of the government, is trying to resist change. It is trying to justify the status quo by emphasising that cases of negative childbirth outcomes among incarcerated women are very rare. However, the author counters this by saying that the only reason this is so is that the data is lacking.

Option C comes the closest to capturing the idea, and hence, is the correct answer.

The ministry of justice does not support that there is a lack of data. Option A can be eliminated.

Option B though true, does not completely capture the views of the Ministry.

Option D is contrary to what the passage reads and can be eliminated.

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

1. But most analysts believe that neither of these is especially likely given the way the war has played out to date.
2. Wars do not typically end with the total defeat of one side or the other.
3. More commonly, there’s some kind of negotiated settlement — either a ceasefire or more permanent peace treaty.



4. It is possible that the Ukraine conflict turns out to be an exception: that Russian morale collapses completely, leading to utter battlefield defeat, or that Russia inflicts so much pain that Kyiv collapses.

Sol. A brief reading of the sentences suggests that the paragraph is about the war taking place in Ukraine, and how it is likely to end. 2 introduces the topic at hand. 3 necessarily follows 2, as it is a direct add-on to what has been said in 2. 4 then introduces another scenario that is possible, where one side utterly defeats the other. The author then cites this as improbable in 1, a conclusion he comes upon by observing the way the war has progressed until now. Hence, the correct sequence will be 2341.

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

In a letter to his daughter not long after the United States won its independence, Benjamin Franklin branded the bald eagle a “bird of bad moral character.” He wished, he wrote, that it “had not been chosen as the representative of our country.” Many believe that he also lobbied for the turkey as national bird. Despite Franklin’s views, Americans immediately began displaying its image in public ceremonies and on organizational regalia. Yet they simultaneously targeted the living bird for eradication, as they did other predators, such as wolves and coyotes. Newspapers, government officials and ornithologists wrongfully accused the species, which primarily eats fish, of carrying away sheep, calves and pigs—livestock that exceed its lifting power.

- A. The prize of being the national bird comes with its own set of disadvantages, as the bald eagle became a target for eradication.
- B. The common misconceptions about the bald eagle in the USA led to it being targeted for eradication, despite it being adopted as the nation's symbol.
- C. The bald eagle, proposed as a being of bad moral character by Franklin, is ill-suited to be the national bird of the USA.
- D. There are many false stories and misconceptions about the bald eagle due to which it has been eradicated from the USA.

Sol. The paragraph begins by highlighting how the bald eagle was adopted as 'the representative of our country', indicating its place as a national symbol. Although Benjamin Franklin was against this move, the American populace quickly introduced this symbol in public ceremonies and organizational regalia. The author emphasises that despite this being the case, the bald eagle was surprisingly targeted for eradication due to a common misconception among the people. Hence, despite being adopted as the nation's symbol, the bald eagle was hunted due to common misbeliefs about it. Option B comes the closest to capturing this idea and is the correct answer.

- A: Misses out on the fact that the targeting was done due to a set of misconceptions.
- C: Option C distorts what has been mentioned in the paragraph. While Franklin considers the bald eagle as a being of bad moral character, the masses might not have echoed this sentiment since they were quick to introduce it to the mainstream.



D: It has not been mentioned that the bald eagle has been eradicated. Option D is beyond the scope of the paragraph.

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

Thanks to CRISPR gene-editing technology, truly hypoallergenic cats could soon steal people's hearts and safely curl up on their laps without triggering sneezes, itchy eyes or other allergy symptoms. InBio, a United States biotech company, has found a way to block genes responsible for a major cat allergen using CRISPR, a genetic engineering technique that allows scientists to add or remove bits of DNA at a specific location in an organism's genome. Gizmodo's Ed Cara reports the find is the first step toward hypoallergenic cats as healthy as felines with unedited genes. Details on the project called CRISPR Cat were published this month in The CRISPR Journal.

- A. CRISPR is a gene-editing process designed with the aim of creating healthy hypoallergenic cats who would not produce allergens that irritate humans.
- B. Gene editing technology CRISPR would allow the creation of hypoallergenic cats who could remain in human proximity without triggering allergic reactions.
- C. InBio has proposed using CRISPR, a gene-editing technology, to remove the gene in cats responsible for producing allergens that irritate humans.
- D. The CRISPR Journal highlighted a cat created using CRISPR which did not have the gene responsible for creating allergens that trigger allergic reactions.

Sol. The main point that the author wants to convey through the paragraph is that by using a genetic editing process called CRISPR, scientists will be able to create hypoallergenic cats, which could remain in the proximity of humans without triggering allergic reactions. Option B comes the closest to capturing this idea and is the correct answer.

- A: It has not been mentioned that CRISPR was created with the aim of producing hypoallergenic cats. Option A is beyond the scope of the passage.
- C: Option C is a distortion. It implies that InBio is proposing the removal of the gene from cats for good. However, the paragraph merely mentions that a way to do so has been found.
- D: A cat on which the process has already been done has not been mentioned in the paragraph.

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

1. The origin of the editor's mark "TK" is murky. It's what you write when there's a fact or addition you're waiting on.
2. Instead of stopping everything, simply type "TK", and you know you can come back to the draft and fix it later.
3. Our lives are filled with TK moments. It'll come. No need to stop and wait for it.
4. The magic of TK is more interesting. The existence of TK means we don't have to stop and wait for everything to be perfect before we proceed.



Sol. A brief reading of the sentences suggests that the paragraph is about the TK and how it is present in our lives. 12 should be the opening pair, which introduces the concept of TK and how it is used in writing. 4 then turns and mentions how this has a 'magical' side to it. 3 then concludes the paragraph by mentioning how our lives are filled with these TK moments. Hence, the correct sequence will be 1243.

21. 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 result is the fruit known as Mongee bananas, which roughly translates as Incredible bananas.
2. First there were avocados with no stones; now we have bananas with edible skin.
3. A spokesman said the farm was planning to produce 10 times as many such bananas this year.
4. D&T Farm said this involved slowly cooling the banana growth cells to -60C (-76F) before thawing them.
5. A Japanese farm uses what it calls the “freeze thaw awakening method” to grow bananas that have a softer, digestible peel.

Sol. A brief reading of the sentences suggests that the passage is about the invention of bananas that can be eaten whole, without peeling off the skin. 2 sets the context of the passage by introducing the development. 5 then delves into details and adds on to 2. 4 then mentions the process briefly. 1 then concludes the passage by further adding another detail about the bananas.

3 could be the part of the same article the paragraph is about but does not fit in with the other four sentences. It mentions future plans of the farms, which could be the point of discussion a bit later in the article. Hence, 3 is out of context here.

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

1. My town is trying to decide whether or not it should spend millions of dollars preserving a defunct carbon-steel water tower.
2. In fact, freeing the symbol from the object gives it more power and allows it to spread and become ever more relevant.
3. But whether they preserve it or not, the symbol of the tower remains, and the stories we tell ourselves about place and time remain as well.
4. And, as soon as an object becomes a symbol, the object itself becomes separate from that story.

Sol. A brief reading of the sentences suggests that the paragraph must be about the relationship between a symbol and the object it refers to. 1 introduces the topic of the discussion and sets the context. 3 then explains that irrespective of the outcome the symbol will remain. 4 then explains how becoming a symbol separates it from the object itself. 2 then goes a step further



and mentions that this separation might even boost its relevance. Hence, the correct order of the sentences is 1342.

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

The inclination to use possessions for their psychological functions, such as how they make us feel, starts during early childhood and continually gets reinforced throughout the lifespan. Children learn that a teddy bear or blanket provides them with comfort when they are separated from their parents. Teenagers learn what is cool from their peers and typically want what they have. If one has experienced peer rejection, conflict or belongs to an unsupportive family, they might rely on objects more than themselves or other people. They might view objects as more remarkable than their own personal qualities, and they may seem more readily available than supportive friends or relatives.

- A. People who like to use possessions for their psychological functions generally value them more than they value their own personal qualities.
- B. Peer rejection and unsupportive family can lead to the compulsive need for possessions, valuing them more than one's innate qualities or support network.
- C. Certain possessions have a psychological effect on people, where they play the role of providing comfort, which unsupportive relationships fail to do.
- D. The propensity to use possessions (for certain psychological functions) that develops during early childhood could heighten when regularly exposed to unsupportive environments.

Sol. The main points of the paragraph are:

1. Using possessions for their psychological functions is something we learn at a young age, which is then reinforced again and again.
2. If one is constantly subjected to an unsupportive environment, they might start valuing those possessions more than their own qualities.

- A: The generalization mentioned in Option A has not been implied in the paragraph.
- B: Misses out on point 1.
- C: Option C misses out on parts of both points 1 and 2.
- D: Option D comes the closes in capturing both the points, and is the correct answer.

24. 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. But I wonder if there are unhelpful dichotomies in play, where we pit 'knowledge' against lived experience, against emotional engagement
2. The American poet Wallace Stevens wrote of 13 ways of looking at a blackbird. Perhaps there are different ways of knowing about a blackbird too.
3. Natural history can certainly accommodate a profusion of perspectives - indeed, it will always benefit from greater diversity in how we look and think.



- Perhaps, in different knowledge systems, different traditions of learning, there are different blackbirds.
- Yet there are as many ways of finding meaning in nature as there are people on our planet - as there are people who have ever lived.

Sol. A brief reading of the sentences tells us that the paragraph is about the way we can interpret nature. 24 form a necessary introductory pair, where they use the example of Blackbird to plant the idea that there can be different perspectives with which to view a blackbird, and different knowledge systems would perceive a blackbird as different. 31 form another pair, which further put the thought to the test. 3 mentions how the different perspectives can help increase diversity, and 1 then talks about how this could be disadvantageous too.

While the other sentences talk about perspective while viewing nature, 5 talks about finding meaning in nature. Thus 5 is out of context here.

Instructions

Two companies, “Lynching Merrill (LM)” and “Bank of South America (BSA)”, are working on a joint project for which they have to form a team of seven members. There have to be two managers, three lawyers and two accountants in the team. A, B, C, D, E, F, G and H are employees for LM, and M, N, O, P, Q, R, S, T are the employees for BSA. B, D, E, Q, R and S are lawyers, A, C, F, O, and P are accountants and H, M, T, G and N are managers.

Some additional information about the group to be formed is given below.

- At least one among M, N and T has to be selected. From G and H, at most, one can be selected.
- H and M cannot be selected together. M and D cannot be selected together. G and P cannot be selected together.
- All the three lawyers cannot be from the same company.
- At most one among A, R and T can be selected. Either A and M are both selected, or none is selected. If B is selected, S has to be selected.
- Both the accountants selected are from different companies.
- Of the selected managers, one needs to be declared the “team leader”. Only H, G and T have the required experience to be the leader. A team cannot be formed without a team leader. If both the selected managers are eligible to be the team leader, then the one whose name comes before alphabetically is declared the leader.

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



25. If 'T' has to be selected for the team, the ratio of possible combinations of teams where 'T' is the leader to where 'T' is not the leader is?

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

Sol. MANAGERS:

At least one among M, N and T has to be selected, and at most, one from G and H can be selected.

M and H cannot be selected together, and at least one of the selected managers must be eligible to be the team leader.

Thus, all the possible combinations of managers are: NT, MG, NH, NG, TG and TH.

MH is not possible since M and H cannot be selected together.

MN is not possible because there is no eligible team leader.

MT is not possible because M and A must be selected together, and A and T cannot be selected together.

LAWYERS:

All three lawyers cannot be from the same company. Thus, at least 1 and at most 2 lawyers from a company can be selected.

Thus, all the possible combinations of lawyers are: BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, and QSD.

BDQ, BDR, BEQ, BER, and BRQ are rejected because S has to be selected if B is selected (from statement 4).

ACCOUNTANTS:

Both the selected accountants must be from different companies.

Thus, all the possible combinations of accountants are: AO, AP, CO, CP, FO, and FP.

From statement 2, H and M, M and D & G and P cannot be selected together, and from statement 4, at most one among A, R and T can be chosen. From statement 6, in the case of multiple employees eligible to be the leader, the employee whose name is alphabetically earlier will be selected.

Keeping these conditions in mind, all the possible combinations of teams are as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	T
MG	BES, QSB, QSE	AO	$3 \times 1 = 3$	G
NH	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, CP, FO, FP	$13 \times 4 = 52$	H
NG	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, FO	$13 \times 2 = 26$	G
TG	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, FO	$7 \times 2 = 14$	G
TH	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	H



Thus, combinations where T is the leader is 28 and where T is not the leader is $14 + 28 = 42$.

Thus, the required ratio = $28 : 42 = 2:3$

Hence, option D is the answer.

26. What is the difference between the total number of possible team formations, where ‘H’ is the leader and where ‘G’ is the leader?

Sol. MANAGERS:

At least one among M, N and T has to be selected, and at most, one from G and H can be selected.

M and H cannot be selected together, and at least one of the selected managers must be eligible to be the team leader.

Thus, all the possible combinations of managers are: NT, MG, NH, NG, TG and TH.

MH is not possible since M and H cannot be selected together.

MN is not possible because there is no eligible team leader.

MT is not possible because M and A must be selected together, and A and T cannot be selected together.

LAWYERS:

All three lawyers cannot be from the same company. Thus, at least 1 and at most 2 lawyers from a company can be selected.

Thus, all the possible combinations of lawyers are: BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, and QSD.

BDQ, BDR, BEQ, BER, and BRQ are rejected because S has to be selected if B is selected (from statement 4).

ACCOUNTANTS:

Both the selected accountants must be from different companies.

Thus, all the possible combinations of accountants are: AO, AP, CO, CP, FO, and FP.

From statement 2, H and M, M and D & G and P cannot be selected together, and from statement 4, at most one among A, R and T can be chosen. From statement 6, in the case of multiple employees eligible to be the leader, the employee whose name is alphabetically earlier will be selected.

Keeping these conditions in mind, all the possible combinations of teams are as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	T
MG	BES, QSB, QSE	AO	$3 \times 1 = 3$	G
NH	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, CP, FO, FP	$13 \times 4 = 52$	H
NG	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, FO	$13 \times 2 = 26$	G
TG	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, FO	$7 \times 2 = 14$	G
TH	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	H



Number of team formations where H is the leader = $52 + 28 = 80$

Number of team formations where G is the leader = $3 + 26 + 14 = 43$

Thus, the required difference = $80 - 43 = 37$

27. What is the total number of possible ways a team can be formed?

Sol. MANAGERS:

At least one among M, N and T has to be selected, and at most, one from G and H can be selected.

M and H cannot be selected together, and at least one of the selected managers must be eligible to be the team leader.

Thus, all the possible combinations of managers are: NT, MG, NH, NG, TG and TH.

MH is not possible since M and H cannot be selected together.

MN is not possible because there is no eligible team leader.

MT is not possible because M and A must be selected together, and A and T cannot be selected together.

LAWYERS:

All three lawyers cannot be from the same company. Thus, at least 1 and at most 2 lawyers from a company can be selected.

Thus, all the possible combinations of lawyers are: BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, and QSD.

BDQ, BDR, BEQ, BER, and BRQ are rejected because S has to be selected if B is selected (from statement 4).

ACCOUNTANTS:

Both the selected accountants must be from different companies.

Thus, all the possible combinations of accountants are: AO, AP, CO, CP, FO, and FP.

From statement 2, H and M, M and D & G and P cannot be selected together, and from statement 4, at most one among A, R and T can be chosen. From statement 6, in the case of multiple employees eligible to be the leader, the employee whose name is alphabetically earlier will be selected.

Keeping these conditions in mind, all the possible combinations of teams are as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	T
MG	BES, QSB, QSE	AO	$3 \times 1 = 3$	G
NH	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, CP, FO, FP	$13 \times 4 = 52$	H
NG	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, FO	$13 \times 2 = 26$	G
TG	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, FO	$7 \times 2 = 14$	G
TH	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	H



Thus, the total number of possible ways to form a team = $28 + 3 + 52 + 26 + 14 + 28 = 151$

28. Additional information for this question: N is also eligible to be a team leader.

How many ways can a team be formed with 'N' as its leader?

- A. 127
- B. 34
- C. 28
- D. 6

Sol. MANAGERS:

At least one among M, N and T has to be selected, and at most, one from G and H can be selected.

M and H cannot be selected together, and at least one of the selected managers must be eligible to be the team leader.

Thus, all the possible combinations of managers are: NT, MG, NH, NG, TG and TH.

MH is not possible since M and H cannot be selected together.

MN is not possible because there is no eligible team leader.

MT is not possible because M and A must be selected together, and A and T cannot be selected together.

LAWYERS:

All three lawyers cannot be from the same company. Thus, at least 1 and at most 2 lawyers from a company can be selected.

Thus, all the possible combinations of lawyers are: BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, and QSD.

BDQ, BDR, BEQ, BER, and BRQ are rejected because S has to be selected if B is selected (from statement 4).

ACCOUNTANTS:

Both the selected accountants must be from different companies.

Thus, all the possible combinations of accountants are: AO, AP, CO, CP, FO, and FP.

From statement 2, H and M, M and D & G and P cannot be selected together, and from statement 4, at most one among A, R and T can be chosen. From statement 6, in the case of multiple employees eligible to be the leader, the employee whose name is alphabetically earlier will be selected.

Keeping these conditions in mind, all the possible combinations of teams are as follows.



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Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	T
MG	BES, QSB, QSE	AO	$3 \times 1 = 3$	G
NH	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, CP, FO, FP	$13 \times 4 = 52$	H
NG	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, FO	$13 \times 2 = 26$	G
TG	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, FO	$7 \times 2 = 14$	G
TH	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	H

If N is also eligible to be a team leader, then the leader of the team with managers N and T will become N since N appears earlier in the alphabet. Also, a team with the managers M and N is possible as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team lead
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	N
MN	BES, QSB, QSE	AO, AP	$3 \times 2 = 6$	N

Thus, there can be $28 + 6 = 34$ possible teams with N as its leader.

29. Additional information for this question: N is also eligible to be a team leader.

How many ways can a team be formed with 'T' as its leader?

- A. 28
- B. 14
- C. 0
- D. 56

Sol. MANAGERS:

At least one among M, N and T has to be selected, and at most, one from G and H can be selected.

M and H cannot be selected together, and at least one of the selected managers must be eligible to be the team leader.

Thus, all the possible combinations of managers are: NT, MG, NH, NG, TG and TH.

MH is not possible since M and H cannot be selected together.

MN is not possible because there is no eligible team leader.

MT is not possible because M and A must be selected together, and A and T cannot be selected together.

LAWYERS:

All three lawyers cannot be from the same company. Thus, at least 1 and at most 2 lawyers from a company can be selected.



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Thus, all the possible combinations of lawyers are: BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, and QSD.

BDQ, BDR, BEQ, BER, and BRQ are rejected because S has to be selected if B is selected (from statement 4).

ACCOUNTANTS:

Both the selected accountants must be from different companies.

Thus, all the possible combinations of accountants are: AO, AP, CO, CP, FO, and FP.

From statement 2, H and M, M and D & G and P cannot be selected together, and from statement 4, at most one among A, R and T can be chosen. From statement 6, in the case of multiple employees eligible to be the leader, the employee whose name is alphabetically earlier will be selected.

Keeping these conditions in mind, all the possible combinations of teams are as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	T
MG	BES, QSB, QSE	AO	$3 \times 1 = 3$	G
NH	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, CP, FO, FP	$13 \times 4 = 52$	H
NG	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, FO	$13 \times 2 = 26$	G
TG	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, FO	$7 \times 2 = 14$	G
TH	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	H

If N is also eligible to be a team leader, then the leader of the team with managers N and T will become N since N appears earlier in the alphabet.

Also, a team with the managers M and N is possible as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	N
MN	BES, QSB, QSE	AO, AP	$3 \times 2 = 6$	M

Thus, there are no teams where T is appointed as the leader.

Hence, option C is the required answer.

30. What is the probability of A being selected for the team?

- A. $\frac{3}{151}$
- B. $\frac{3}{145}$
- C. $\frac{3}{148}$
- D. $\frac{6}{37}$



Sol. MANAGERS:

At least one among M, N and T has to be selected, and at most, one from G and H can be selected.

M and H cannot be selected together, and at least one of the selected managers must be eligible to be the team leader.

Thus, all the possible combinations of managers are: NT, MG, NH, NG, TG and TH.

MH is not possible since M and H cannot be selected together.

MN is not possible because there is no eligible team leader.

MT is not possible because M and A must be selected together, and A and T cannot be selected together.

LAWYERS:

All three lawyers cannot be from the same company. Thus, at least 1 and at most 2 lawyers from a company can be selected.

Thus, all the possible combinations of lawyers are: BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, and QSD.

BDQ, BDR, BEQ, BER, and BRQ are rejected because S has to be selected if B is selected (from statement 4).

ACCOUNTANTS:

Both the selected accountants must be from different companies.

Thus, all the possible combinations of accountants are: AO, AP, CO, CP, FO, and FP.

From statement 2, H and M, M and D & G and P cannot be selected together, and from statement 4, at most one among A, R and T can be chosen. From statement 6, in the case of multiple employees eligible to be the leader, the employee whose name is alphabetically earlier will be selected.

Keeping these conditions in mind, all the possible combinations of teams are as follows.

Managers	Lawyers	Accountants	No. of possibilities	Team leader
NT	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	T
MG	BES, QSB, QSE	AO	$3 \times 1 = 3$	G
NH	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, CP, FO, FP	$13 \times 4 = 52$	H
NG	BDS, BES, DEQ, DER, DES, QRD, QRE, RSB, RSD, RSE, QSB, QSE, QSD	CO, FO	$13 \times 2 = 26$	G
TG	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, FO	$7 \times 2 = 14$	G
TH	BDS, BES, DEQ, DES, QSB, QSE, QSD	CO, CP, FO, FP	$7 \times 4 = 28$	H

Number of possible teams where A is selected = 3

The total number of ways that a team can be formed = 151

Thus, the probability of A being selected in the team = $\frac{3}{151}$

Hence, option A is the answer.



Instructions

A mathematician designed a puzzle for his friends. In this puzzle, an $m \times n$ matrix is given, in which some cells are filled with numbers while some are crossed out. A number in a cell represents the total number of consecutively connected numbered cells in the row and column to the cell [except the concerned cell]. Cells that are not needed are crossed out.

For example, consider a 3×3 form of the puzzle as follows.

1		
	2	X
2		

Consider column 1 of this matrix. Since the first cell has 1, it will only have one number-filled cell connected.

If the middle cell is filled, the first cell will have two consecutively numbered cells, which is impossible. Thus, the central cell of the first column is crossed out.

1		
X	2	X
2		

The only way the first cell will have one other number-filled cell connected is if the cell next to it in the first row is filled with a number.

Similarly, for the third cell in column 1, both the consecutive cells in the third row will be filled with numbers.

1	-	X
X	2	X
2	-	-

Finally, we get the final matrix by filling appropriate values in the non-crossed cells.

1	3	X
X	2	X
2	4	2

Based on this information, solve the following questions.

31. In the given 3x4 puzzle, what will be the sum of values in column 3?

5			
	X		X
2		2	

- A. 5
- B. 6
- C. 9
- D. 8

Sol. The given matrix is as follows.

5			
	X		X
2		2	

Since there are a total of 5 cells, around any cell, in row and column, all the cells in the first row and the first column will be numbered.

5	3		3
2	X		X
2	X	2	

The only way to fill the matrix is to cross out the 3rd row and 4th column matrix and fill all the cells in the third column. Thus, the final matrix becomes.

5	3	5	3
2	X	2	X
2	X	2	X

Hence, the sum of values in column 3 is = 5 + 2 + 2 = 9

The answer is option C.

32. In the given 4 x 4 matrix, how many columns are similar?

		4	4
	3		3
	X		
4		3	



- A. 0
- B. 2
- C. 4
- D. 3

Sol. The given matrix is as follows.

		4	4
	3		3
	X		
4		3	

There are two ways of filling the above matrix.

Case 1:

X	X	4	4
	3	-	3
	X	-	
4	X	3	X

But in this case, there are only two free cells adjacent to the highlighted cell, whereas we need 4. Thus, this case is not valid.

Case 2:

-	-	4	4
X	3	-	3
-	X	X	X
4	-	3	-

This case does not have any violation of conditions and thus is a valid one.

Filling the blank cells with appropriate numbers, we get the final matrix.

3	4	4	4
X	3	3	3
1	X	X	X
4	3	3	3

Thus, we can see that columns 2, 3, and 4 are similar.

Hence, the answer is option D.

33. How many possible solutions are there for the below 3×3 matrix?

2		
		2
		X

Sol. The given matrix is as follows.

2		
		2
		X

For the first row-first column cell, there are three possible ways of being connected to two numbered cells.

Case 1:

2	-	-
X	-	2
		X

The two empty cells in the third row can further be filled in 3 possible ways.

Case 1. a: Both cells are crossed out.

2	-	-
X	-	2
X	X	X

By filling the blank cells, we get the final matrix.

2	3	3
X	2	2
X	X	X



Case 1. b: The left cell is crossed and the right one is numbered

2	-	-
X	-	2
X	-	X

By filling the blank cells, we get the final matrix.

2	4	3
X	3	2
X	2	X

Case 1. c: The right cell is crossed and the left one is numbered

2	-	-
X	-	2
-	X	X

By filling the blank cells, we get the final matrix.

2	3	3
X	2	2
0	X	X

Case 1. d: Both the cells are numbered

2	-	-
X	-	2
-	-	X

By filling the blank cells, we get the final matrix.

2	4	3
X	3	2
1	3	X



Hence, there are 4 possible solutions in this case.

Case 2:

2	X	X
-	-	2
-		X

The row 3 - column 2 cell can either be numbered or crossed.

Case 2. a: The cell is numbered

2	X	X
4	3	2
3	2	X

Case 2. b: The cell is crossed.

2	X	X
4	2	2
2	X	X

Hence, there are 2 valid solutions in this case.

Case 3:

2	-	X
-	-	2
X		X

The row 3 - column 2 cell can either be numbered or crossed.

Case 3. a: The cell is numbered

2	3	X
3	4	2
X	2	X



Case 3. b: The cell is crossed

2	2	X
3	3	2
X	X	X

Thus, there are 2 valid solutions in this case.

The total number of valid solutions to the given puzzle = 4 + 2 + 2 = 8.

34. Consider the following 6 × 6 matrix for the remaining questions.

		1			1
		3			
5	2			3	
		3		3	X
X	X	X	3		3

What is the highest number in a cell?

Sol. The given matrix is as follows.

		1			1
		3			
5	2			3	
		3		3	X
X	X	X	3		3

First, the obvious cells are crossed out.

-	X	1	X		1
-		3			
5	2	X		3	
-		3		3	X
-					
X	X	X	3		3



Now consider the 2 in the second column. It is already connected to a numbered cell; thus, it needs one more numbered cell. It could be either the one above it or the one below.

Case 1:

-	X	1	X	-	1
-	-	3	X	X	X
5	2	X	-	3	-
-	X	3	-	3	X
-		-		X	
X	X	X	3		3

After filling the blank cells, we get.

<u>4</u>	X	1	X	1	1
<u>6</u>	<u>3</u>	3	X	X	X
5	2	X	-	3	2
<u>4</u>	X	3	-	3	X
-		-	-	X	1
X	X	X	3	2	3

The highlighted cell has a total of 5 numbered cells connected to it, which violated the criteria. Thus, this case is invalid.

Case 2:

-	X	1	X	-	1
-	X	3	-	-	X
5	2	X	X	3	X
-	-	3	X	3	X
-	X	-	-	X	-
X	X	X	3	-	3

In this case, there are no violations of the given conditions.

Filling the blank cells with appropriate numbers, we get the final matrix.

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



Thus, the highest number in a cell is 6.

35. Consider the following 6 × 6 matrix for the remaining questions.

		1			1
		3			
5	2			3	
		3		3	X
X	X	X	3		3

What is the ratio of the number of crossed-out cells to the numbered cells?

- A. 13 : 23
- B. 11 : 7
- C. 7:18
- D. 7:11

Sol. The given matrix is as follows.

		1			1
		3			
5	2			3	
		3		3	X
X	X	X	3		3

First, the obvious cells are crossed out.

-	X	1	X		1
-		3			
5	2	X		3	
-		3		3	X
-					
X	X	X	3		3

Now consider the 2 in the second column. It is already connected to a numbered cell; thus, it needs one more numbered cell. It could be either the one above it or the one below.



Case 1:

–	X	1	X	–	1
–	–	3	X	X	X
5	2	X	–	3	–
–	X	3	–	3	X
–		–		X	
X	X	X	3		3

After filling the blank cells, we get.

<u>4</u>	X	1	X	1	1
<u>6</u>	<u>3</u>	3	X	X	X
5	2	X	–	3	2
<u>4</u>	X	3	–	3	X
–		–	–	X	1
X	X	X	3	2	3

The highlighted cell has a total of 5 numbered cells connected to it, which violated the criteria. Thus, this case is invalid.

Case 2:

–	X	1	X	–	1
–	X	3	–	–	X
5	2	X	X	3	X
–	–	3	X	3	X
–	X	–	–	X	–
X	X	X	3	–	3

In this case, there are no violations of the given conditions.

Filling the blank cells with appropriate numbers, we get the final matrix.

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



The total number of crossed cells in the matrix = 14

The total number of numbered cells in the matrix = $36 - 14 = 22$

Thus, the required ratio = $14 : 22 = 7 : 11$

The answer is option D.

36. Consider the following 6×6 matrix for the remaining questions.

		1			1
		3			
5	2			3	
		3		3	X
X	X	X	3		3

What is the maximum number of times a number is repeated in the matrix?

Sol. The given matrix is as follows.

		1			1
		3			
5	2			3	
		3		3	X
X	X	X	3		3

First, the obvious cells are crossed out.

-	X	1	X		1
-		3			
5	2	X		3	
-		3		3	X
-					
X	X	X	3		3



Now consider the 2 in the second column. It is already connected to a numbered cell; thus, it needs one more numbered cell. It could be either the one above it or the one below.

Case 1:

-	X	1	X	-	1
-	-	3	X	X	X
5	2	X	-	3	-
-	X	3	-	3	X
-		-		X	
X	X	X	3		3

After filling the blank cells, we get.

<u>4</u>	X	1	X	1	1
<u>6</u>	<u>3</u>	3	X	X	X
5	2	X	-	3	2
<u>4</u>	X	3	-	3	X
-		-	-	X	1
X	X	X	3	2	3

The highlighted cell has a total of 5 numbered cells connected to it, which violated the criteria. Thus, this case is invalid.

Case 2:

-	X	1	X	-	1
-	X	3	-	-	X
5	2	X	X	3	X
-	-	3	X	3	X
-	X	-	-	X	-
X	X	X	3	-	3

In this case, there are no violations of the given conditions.

Filling the blank cells with appropriate numbers, we get the final matrix.



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

Counting the total number of appearances of each number in the matrix, we get the below table.

Number	1	2	3	4	5	6
Number of appearances	3	5	7	4	2	1

Thus, 3 has been repeated a maximum number of times, i.e., 7.

Hence, the answer is 7.

Instructions

Five friends met after three years and wanted to celebrate their togetherness with food and games. Each of them is from a different city and has a different taste for food. Five have suggested five different items: Biryani, Dosa, Pizza, Sandwich, and Vada Pav. Each of them has different priority order for food. No two prefer the same item in the same place. For example, if Aparna's first priority is Biryani, then none of the remaining friends has the first priority as Biryani. Five of them are from Chennai, Delhi, Hyderabad, Kolkata and Mumbai. Five of them have travelled different distances to reach Goa, i.e. 100 km, 150 km, 200 km, 250 km and 350 km, in no particular order.

1. The person whose first priority is Sandwich is from Chennai and travelled the least distance to reach Goa.
2. The person whose fourth priority is Biryani travelled from Mumbai, and the distance travelled by him is more than the distance travelled by Eshwar.
3. Bunty's first priority is the same as Diana's third priority and Aparna's second priority is the same as Eshwar's first priority
4. Distance travelled by Aparna is the sum of distances travelled by Bunty and Eshwar; none of them has travelled the least distance.
5. Aparna's first priority is the same as Celina's last priority.
6. Bunty's second priority is the same as Diana's last priority
7. The person whose third priority is Vada Pav reached Goa from the farthest city i.e. Kolkata.
8. Celina's fourth priority is Sandwich.



37. How many arrangements is/are possible considering all the attributes?

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

Sol.

Place	Name						Distance
	Aparna						
	Bunty						
	Celina						
	Diana						
	Eshwar						

In statement 3, it is given that Bunty’s first priority is the same as Diana’s third priority and Aparna’s second priority is the same as Eshwar’s first priority. In statement 5, it is given that Aparna’s first priority is the same as Celina’s last priority and in statement 6 it is given that Bunty’s second priority is the same as Diana’s last priority.

All the above statements satisfy different food items only.

Therefore, we can represent the data as below.

Place	Name						Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			5			
	Diana	3			5		
	Eshwar		1				

In statement 8, it is given that Celina’s fourth priority is Sandwich. In statement 1, it is mentioned that the person whose first priority is Sandwich is from Chennai and travelled the least distance to reach Goa.

If 4 is placed in column 3 or 4, it implies that either Bunty or Eshwar travelled the least distance, but in statement 1, it is mentioned none of them travelled the least distance to reach Goa. Therefore, 4 is not placed in column 3 or column 4.

It cannot be placed in column 5 as 5 is already there. If 4 is placed in column 6, we cannot fill the column. Therefore, 4 is placed in row 4 and column 7.

Place	Name					Sandwich	Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			5		4	
Chennai	Diana	3			5	1	100 km
	Eshwar		1				



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It is mentioned that no two prefer the same item in the same place. Therefore, we can fill the table accordingly.

Place	Name					Sandwich	Distance
	Aparna	4	2	1	3	5	
	Bunty	1	5	4	2	3	
	Celina	2	3	5	1	4	
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	

In statement 4, it is mentioned that the distance travelled by Aparna is the sum of the distances travelled by Bunty and Eshwar; none of them has travelled the least distance. Therefore, the distance travelled by Aparna is 350 km, and the distance travelled by Bunty and Eshwar will be 150 km and 200 km.

Place	Name					Sandwich	Distance
	Aparna	4	2	1	3	5	350 km
	Bunty	1	5	4	2	3	150/200
	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	200/150

In statement 7, it is mentioned that the person whose third priority is Vada Pav reached Goa from the farthest city, i.e. Kolkata. Aparna has arrived from the farthest city. Therefore, Aparna's third priority is Vada Pav.

Place	Name				VadaPav	Sandwich	Distance
Kolkata	Aparna	4	2	1	3	5	350 km
	Bunty	1	5	4	2	3	150/200
	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	200/150

In statement 2, it is mentioned that the person whose fourth priority is Biryani travelled from Mumbai, and his distance is more than the distance travelled by Eshwar. They cannot be Aparna or Diana, as they travelled from Kolkata and Chennai. They cannot be Celina, as Celina's fourth priority is Sandwich. They cannot be Eshwar also, as it is mentioned that they travelled more than Eshwar. Therefore, Bunty's fourth priority is Biryani.



Final arrangement:

Place	Name	Dosa/Pizza	Pizza/Dosa	Biryani	VadaPav	Sandwich	Distance
Kolkata	Aparna	4	2	1	3	5	350 km
Mumbai	Bunty	1	5	4	2	3	200 km
Hyd/Delhi	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
Delhi/Hyd	Eshwar	5	1	3	4	2	150 km

There are four arrangements possible.

Answer is option C.

38. Whose last priority is Sandwich?

- A. The one from Kolkata
- B. The one from Mumbai
- C. The one from Delhi
- D. Cannot be determined

Sol.

Place	Name						Distance
	Aparna						
	Bunty						
	Celina						
	Diana						
	Eshwar						

In statement 3, it is given that Bunty’s first priority is the same as Diana’s third priority and Aparna’s second priority is the same as Eshwar’s first priority. In statement 5, it is given that Aparna’s first priority is the same as Celina’s last priority and in statement 6 it is given that Bunty’s second priority is the same as Diana’s last priority. All the above statements satisfy different food items only. Therefore, we can represent the data as below.

Place	Name						Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			5			
	Diana	3			5		
	Eshwar		1				



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In statement 8, it is given that Celina's fourth priority is Sandwich. In statement 1, it is mentioned that the person whose first priority is Sandwich is from Chennai and travelled the least distance to reach Goa.

If 4 is placed in column 3 or 4, it implies that either Bunty or Eshwar travelled the least distance, but in statement 1, it is mentioned none of them travelled the least distance to reach Goa. Therefore, 4 is not placed in column 3 or column 4.

It cannot be placed in column 5 as 5 is already there. If 4 is placed in column 6, we cannot fill the column. Therefore, 4 is placed in row 4 and column 7.

Place	Name					Sandwich	Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			5		4	
Chennai	Diana	3			5	1	100 km
	Eshwar		1				

It is mentioned that no two prefer the same item in the same place. Therefore, we can fill the table accordingly.

Place	Name					Sandwich	Distance
	Aparna	4	2	1	3	5	
	Bunty	1	5	4	2	3	
	Celina	2	3	5	1	4	
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	

In statement 4, it is mentioned that the distance travelled by Aparna is the sum of the distances travelled by Bunty and Eshwar; none of them has travelled the least distance. Therefore, the distance travelled by Aparna is 350 km, and the distance travelled by Bunty and Eshwar will be 150 km and 200 km.

Place	Name					Sandwich	Distance
	Aparna	4	2	1	3	5	350 km
	Bunty	1	5	4	2	3	150/200
	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	200/150

In statement 7, it is mentioned that the person whose third priority is Vada Pav reached Goa from the farthest city, i.e. Kolkata. Aparna has arrived from the farthest city. Therefore, Aparna's third priority is Vada Pav.



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Place	Name				VadaPav	Sandwich	Distance
Kolkata	Aparna	4	2	1	3	5	350 km
	Bunty	1	5	4	2	3	150/200
	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	200/150

In statement 2, it is mentioned that the person whose fourth priority is Biryani travelled from Mumbai, and his distance is more than the distance travelled by Eshwar. They cannot be Aparna or Diana, as they travelled from Kolkata and Chennai. They cannot be Celina, as Celina's fourth priority is Sandwich. They cannot be Eshwar also, as it is mentioned that they travelled more than Eshwar. Therefore, Bunty's fourth priority is Biryani.

Final arrangement:

Place	Name	Dosa/Pizza	Pizza/Dosa	Biryani	VadaPav	Sandwich	Distance
Kolkata	Aparna	4	2	1	3	5	350 km
Mumbai	Bunty	1	5	4	2	3	200 km
Hyd/Delhi	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
Delhi/Hyd	Eshwar	5	1	3	4	2	150 km

Aparna's last priority is Sandwich and Aparna is from Kolkata.

Therefore, answer is option A.

39. Who has arrived from Mumbai?

- A. Aparna
- B. Bunty
- C. Celina
- D. Diana

Sol.

Place	Name						Distance
	Aparna						
	Bunty						
	Celina						
	Diana						
	Eshwar						

In statement 3, it is given that Bunty's first priority is the same as Diana's third priority and Aparna's second priority is the same as Eshwar's first priority. In statement 5, it is given that



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Aparna's first priority is the same as Celina's last priority and in statement 6 it is given that Bunty's second priority is the same as Diana's last priority.

All the above statements satisfy different food items only.

Therefore, we can represent the data as below.

Place	Name						Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			5			
	Diana	3			5		
	Eshwar		1				

In statement 8, it is given that Celina's fourth priority is Sandwich. In statement 1, it is mentioned that the person whose first priority is Sandwich is from Chennai and travelled the least distance to reach Goa.

If 4 is placed in column 3 or 4, it implies that either Bunty or Eshwar travelled the least distance, but in statement 1, it is mentioned none of them travelled the least distance to reach Goa. Therefore, 4 is not placed in column 3 or column 4.

It cannot be placed in column 5 as 5 is already there. If 4 is placed in column 6, we cannot fill the column. Therefore, 4 is placed in row 4 and column 7.

Place	Name					Sandwich	Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			5		4	
Chennai	Diana	3			5	1	100 km
	Eshwar		1				

It is mentioned that no two prefer the same item in the same place. Therefore, we can fill the table accordingly.

Place	Name					Sandwich	Distance
	Aparna	4	2	1	3	5	
	Bunty	1	5	4	2	3	
	Celina	2	3	5	1	4	
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	

In statement 4, it is mentioned that the distance travelled by Aparna is the sum of the distances travelled by Bunty and Eshwar; none of them has travelled the least distance. Therefore, the distance travelled by Aparna is 350 km, and the distance travelled by Bunty and Eshwar will be 150 km and 200 km.



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Place	Name					Sandwich	Distance
	Aparna	4	2	1	3	5	350 km
	Bunty	1	5	4	2	3	150/200
	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	200/150

In statement 7, it is mentioned that the person whose third priority is Vada Pav reached Goa from the farthest city, i.e. Kolkata. Aparna has arrived from the farthest city. Therefore, Aparna's third priority is Vada Pav.

Place	Name				VadaPav	Sandwich	Distance
Kolkata	Aparna	4	2	1	3	5	350 km
	Bunty	1	5	4	2	3	150/200
	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
	Eshwar	5	1	3	4	2	200/150

In statement 2, it is mentioned that the person whose fourth priority is Biryani travelled from Mumbai, and his distance is more than the distance travelled by Eshwar. They cannot be Aparna or Diana, as they travelled from Kolkata and Chennai. They cannot be Celina, as Celina's fourth priority is Sandwich. They cannot be Eshwar also, as it is mentioned that they travelled more than Eshwar. Therefore, Bunty's fourth priority is Biryani.

Final arrangement:

Place	Name	Dosa/Pizza	Pizza/Dosa	Biryani	VadaPav	Sandwich	Distance
Kolkata	Aparna	4	2	1	3	5	350 km
Mumbai	Bunty	1	5	4	2	3	200 km
Hyd/Delhi	Celina	2	3	5	1	4	250 km
Chennai	Diana	3	4	2	5	1	100 km
Delhi/Hyd	Eshwar	5	1	3	4	2	150 km

Bunty has arrived from Mumbai.

Answer is option B.

40. In statement 5, if it is given that Aparna's first priority is the same as Celina's third priority, how many arrangements is/are possible considering all the attributes?

Sol. In statement 5, if it is given that Aparna's first priority is the same as Celina's third priority, then there are two cases.



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Case 1:

Place	Name						Distance
	Aparna		2	1			
	Bunty	1			2		
	Celina			3		4	
	Diana	3			5		
	Eshwar		1				

Case 2:

Place	Name						Distance
	Aparna		2		1		
	Bunty	1			2		
	Celina				3	4	
	Diana	3			5		
	Eshwar		1				

It is mentioned that no two prefer the same item in the same place. Therefore, we can fill the table accordingly.

Case 1:

Place	Name					Sandwich	Distance
	Aparna	5	2	1	4	3	
	Bunty	1	3	4	2	5	
Chennai	Celina	2	5	3	1	4	100 km
	Diana	3	4	2	5	1	
	Eshwar	4	1	5	3	2	

Case 2:

Place	Name					Sandwich	Distance
	Aparna	4	2	5	1	3	
	Bunty	1	3	4	2	5	
Chennai	Celina	2	5	1	3	4	100 km
	Diana	3	4	2	5	1	
	Eshwar	5	1	3	4	2	

In statement 7, it is mentioned that the person whose third priority is Vada Pav reached Goa from the farthest city, i.e. Kolkata. Aparna has arrived from the farthest city. This implies Aparna's third priority is Vada Pav. But in both cases, Aparna's third priority is Sandwich. Therefore, no arrangement is possible to satisfy all the given conditions. The answer is 0.

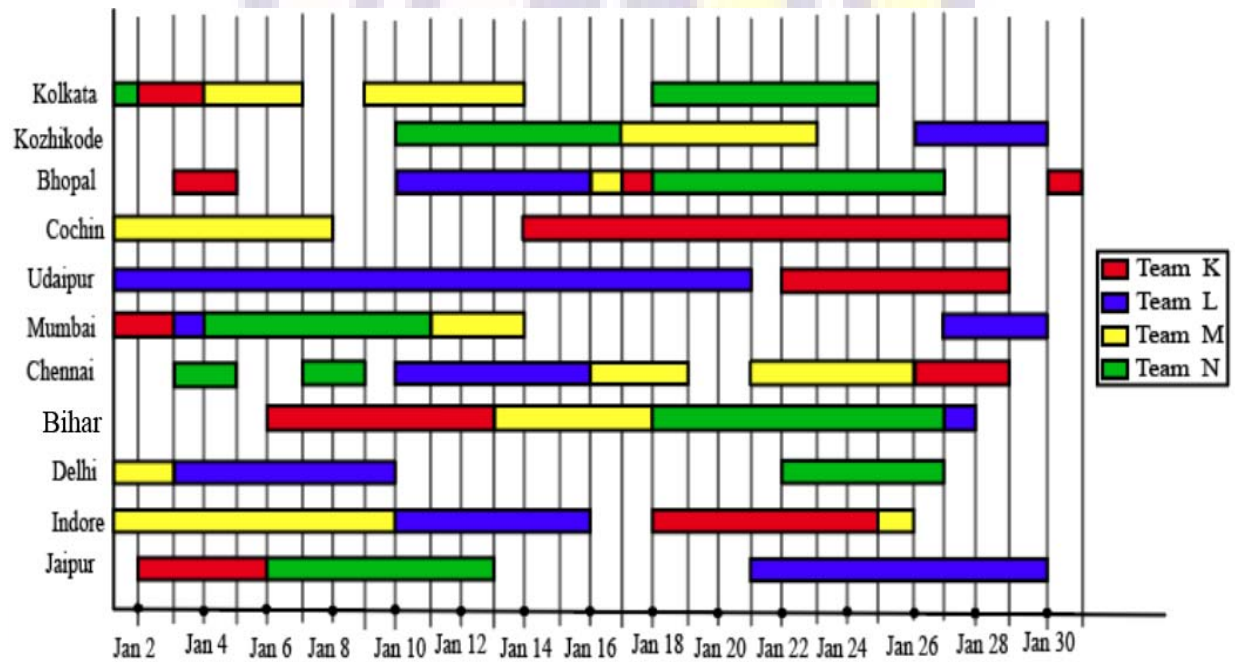


Instructions

An event planning company ‘SHUBHAM’ has received several orders from different places in the month of January, as shown below. There are four teams in the company. Each team can plan multiple events at a time.

The left endpoint of the bar indicates the start date of planning the event, and the right end of the bar indicates the end date. The number of days between start date and end date of planning is termed as 'Planning duration of the event'. Planning of all the orders received in January are done by January 31.

For example, in Kolkata, there was an event organized by Team N from Jan 1- Jan 2 and then Team K organized a different event from Jan 2 to Jan 4. Also, there was one more event organized by team N, which ended on Jan 25.



41. Which team has planned the maximum number of events?

- A. Team K
- B. Team L
- C. Team M
- D. Team N

Sol. Number of events planned by Team K (Red) = 11

Number of events planned by Team L (Blue) = 10

Number of events planned by Team M (Yellow) = 12

Number of events planned by Team N(Green) = 10

Team M planned maximum number of events.

Answer is option C.



42. Which team has planned minimum number of events received from the cities Kolkata, Bhopal, Mumbai and Chennai?

- A. Team K
- B. Team L
- C. Team M
- D. Team N

Sol. Team K - Kolkata(1) + Bhopal(3) + Chennai(1) + Mumbai(1) = 6

Team L - Kolkata(0) + Bhopal(1) + Chennai(1) + Mumbai(2) = 4

Team M - Kolkata(2) + Bhopal(1) + Chennai(2) + Mumbai(1) = 6

Team N - Kolkata(2) + Bhopal(1) + Chennai(2) + Mumbai(1) = 6

Team L planned minimum number of events.

The answer is option B.

43. What percentage of events had a planning duration of more than five days?

- A. 44.2%
- B. 53.5%
- C. 48.8%
- D. 51.3%

Sol. Out of 43 events, there are 19 events which took more than five days of planning

$$\text{Required percentage} = \frac{19}{43} \times 100 = 44.18\% \approx 44.2\%$$

Answer is option A.

44. Which team worked on the maximum number of events simultaneously?

- A. Team K and Team N
- B. Team L and Team M
- C. Team L and Team N
- D. Team K and Team M

Sol. Team L and N has planned maximum number of events simultaneously. Both the team planned four events at a time.

Team L - Jan 10 - Jan 16 (6 days)

Team N - Jan 22 - Jan 25 (3 days)

Answer is option C.



45. The price of the new iPhone is Rs.50000 in India, but it is sold at a 30% lower price in Dubai. Seeing this opportunity, Mr. Phonewala decided to buy iPhones from Dubai and sell them in India at a lower price. The import charge was 10% of the cost in Dubai, and an equal amount was charged as a markup by Mr. Phonewala. How much discount(in Rupees) will the other sellers have to provide to compete with Mr. Phonewala's price?.

Sol. Let SP_1 , SP_D and SP_2 be the selling prices of iPhones in India, Dubai and by Mr. Phonewala.

Thus, $SP_1 = 50000$

iPhones are sold at a 30% lower price in Dubai, thus

$$SP_D = 0.7 * 50000 = 35000$$

It takes 10% of the SP_D to import the phones and an equal amount is added as a mark-up by Mr. Phonewala.

$$\text{Thus, } SP_2 = 35000 + 0.1(35000) + 0.1(35000) = 42000$$

The discount that the other sellers will have to provide in order to compete with Mr. Phonewala = $50000 - 42000 = 8000$

46. In XYZ school, the class 10th has two sections: A and B. Section A has boys and girls in a ratio of 7:8, whereas section B has girls and boys in a ratio of 3:2. If the classes are merged, the resultant ratio of boys and girls would be 4:5. The total number of students in section B is what percentage of the number of students in section A?

- A. 12.5%
- B. 33.33%
- C. 200%
- D. 50%

Sol. Let the number of boys and girls in section A be $7x$ and $8x$ respectively and in section B be $2y$ and $3y$ respectively.

If the classes are merged the ratio becomes:

$$\frac{7x+2y}{8x+3y} = \frac{4}{5}$$

$$35x + 10y = 32x + 12y$$

$$y = \left(\frac{3}{2}\right)x$$

Thus, total number of students in section A = $15x$ and in section B = $5y = \left(\frac{15}{2}\right)x$

Thus, the percentage of students in section B to A = $\frac{\frac{15}{2} \times 100}{15} = 50\%$

Hence, the answer is option D.



47. An alloy contains carbon and iron in a ratio of 3:4, and another alloy contains carbon and zinc in a ratio of 2:1. In what ratio are these two alloys mixed if the final alloy has a carbon concentration of 50%?

- A. 3:2
- B. 7:3
- C. 5:2
- D. 2:1

Sol. The first alloy has carbon in the proportion of $\frac{3}{7}$, the second alloy has a carbon proportion of $\frac{2}{3}$, and the final alloy has a carbon proportion of $\frac{1}{2}$.

Let these two alloys are mixed in the ratio of a:b. Thus, the proportion of carbon in the final alloy is given by:

$$[(\frac{3}{7})a + (\frac{2}{3})b]/(a + b) = \frac{1}{2} \text{ ..(taking the weighted average)}$$

$$(\frac{3}{7})a + (\frac{2}{3})b = (\frac{1}{2})a + (\frac{1}{2})b$$

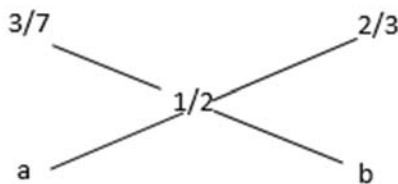
$$(\frac{1}{6})b = (\frac{1}{14})a$$

$$(a/b) = (\frac{7}{3})$$

Thus, the two alloys are mixed in a ratio of 7:3.

Hence, option B is the answer.

Alternately, using alligations



$$(a/b) = (\frac{2}{3} - \frac{1}{2})/(\frac{1}{2} - \frac{3}{7})$$

$$(a/b) = (\frac{1}{6})/(\frac{1}{14}) = \frac{7}{3}$$

48. If product of a internal angle and external angle of a n-sided polygon is 7776, find number of diagonals of the polygon

- A. 5
- B. 9
- C. 14
- D. 20

Sol. $\frac{(n-2)180}{n} \times \frac{360}{n} = 7776$

$$\frac{n-2}{n^2} = \frac{3}{25}$$

$$25n - 50 = 3n^2$$

$$3n^2 - 25n + 50 = 0$$

$$3n^2 - 15n - 10n + 50 = 0$$

$$3n(n - 5) - 10(n - 5) = 0$$

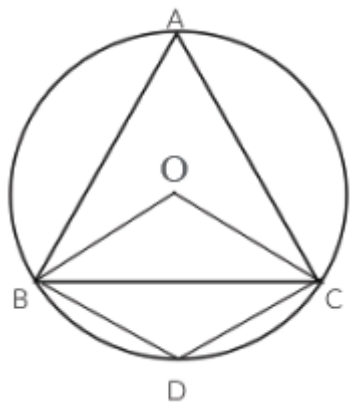
$$(3n-10)(n-5) = 0$$

As n cannot be equal to $10/3$, $n = 5$

$$\text{Number of diagonals} = 5C_2 - 5 = 10 - 5 = 5$$

Answer is option A.

49. Find area of triangle BOC, if radius of circle is 10 cm and $\angle ABO = \angle ACO = 15^\circ$ (O is centre of circle)



A. $25\sqrt{3}$ cm²

B. 50 cm²

C. $25\sqrt{2}$ cm²

D. 75 cm²

Sol. Let $\angle OBC = x$, $\angle OCB = x$

$$\angle BOC = 180 - 2x$$

$$\angle BAC = 90 - x$$

Sum of all angles of a triangle = 180

In triangle ABC,

$$15 + x + 15 + x + 90 - x = 180$$

$$120 + x = 180$$

$$x = 60$$

$$\angle BOC = 180 - 120 = 60^\circ$$

$$\text{Area of triangle BOC} = \frac{1}{2} (BO)(OC) \sin \angle BOC$$

$$= \frac{1}{2} \times 10 \times 10 \times \frac{\sqrt{3}}{2}$$

$$= 25\sqrt{3} \text{ cm}^2$$

Answer is option A



50. $\frac{\log 81 + \log 375 - \log 15}{(\log 35 + \log 63 - \log 49)} = m$ and $\frac{\log 24 + \log 36 + \log 54}{\log 44 + \log 99 - \log 726} = n$.

Find quadratic equation formed with roots m and n

- A. $x^2 - 7x + 10 = 0$
- B. $2x^2 - 9x + 10 = 0$
- C. $x^2 - 8x + 12 = 0$
- D. $4x^2 - 10x + 4 = 0$

Sol. $\frac{\log 81 + \log 375 - \log 15}{\log 35 - \log 49 + \log 63} = \frac{\log\left(\frac{35 \times 63}{49}\right)}{\log\left(\frac{81 \times 375}{15}\right)} = \frac{\log 3^4 \cdot 5^2}{\log 3^2 \cdot 5} = 2$

$\frac{\log 24 + \log 36 - \log 54}{\log 44 - \log 99 + \log 726} = \frac{\log(24 \times 36 \times 54)}{\log\left(\frac{44 \times 99}{726}\right)} = \frac{\log 6^6}{\log 6} = 6$

$m = 2$ and $n = 6$

$m + n = 8$

$mn = 12$

Quadratic equation with roots m and n: $x^2 - 8x + 12 = 0$

Answer is option C.

51. 30 workers working 8 hours a day for 10 days can complete a particular piece of work. The exact amount of work is now being carried out by 40 workers working 10 hours a day. If the workers start working on Monday of a particular week, on which day will the work be complete?

- A. Friday
- B. Saturday
- C. Sunday
- D. Monday

Sol. Let W, H and D denote workers, hours and days.

Thus, the total amount of work = $30W * 8H * 10D = 2400WDH$

The same work is being carried out by 40 workers working 10 hours a day. Thus,

$2400WDH = 40W * 10H * xD$ (where x is the number of days required)

$x = 6$ days.

Thus, the work will be completed on the 6th day. The workers started working on Monday so the work will be completed on Saturday.

Hence, option B is the answer.



52. How many factors of 245000 are not divisible by 10?

Sol. $245000 = 2 \times 1225 \times 100 = 2 \times (35)^2 \times 2^2 \times 5^2 = 2^3 \times 5^4 \times 7^2$

$2^0, 2^1, 2^2, 2^3 / 5^0, 5^1, 5^2, 5^3, 5^4 / 7^0, 7^1, 7^2$

Total number of factors = $(4)(5)(3) = 60$

Number of factors that are divisible by 10 = $(3)(4)(3) = 36$

Therefore, number of factors that are not divisible by 10 = $60 - 36 = 24$

53. Rahim sold two cars at Rs. 100000 each, one at a profit of 25% and the other at a loss of 20%. What was his overall profit/loss (in Rupees)?

Sol. Cost price of the car sold at a profit = $100000 \times (100/125) = 80000$

Cost price of the car sold at a loss = $100000 \times (100/80) = 125000$

Thus, the total cost of both the cars = 205000 and he recovered 200000 after selling both of them.

Thus, the overall loss = $205000 - 200000 = 5000$.

54. If $|x+1| + |x+3| \leq 10$, how many integral values can x take?

- A. 7
- B. 9
- C. 10
- D. 11

Sol. $|x+1| + |x+3| \leq 10$

Case 1: $x \geq -1, x \geq -3$

$x+1+x+3 \leq 10$

$2x+4 \leq 10$

$2x \leq 6$

$x \leq 3$

x can take 5 values (-1, 0, 1, 2, 3)

Case 2: $x \leq -1, x \leq -3$

$-x-1-x-3 \leq 10$

$-2x-4 \leq 10$

$-2x \leq 14$

$x \geq -7$

x can take 5 values (-3, -4, -5, -6, -7)



Case 3: $x \leq -1, x \geq -3$

$$-x-1+x+3 \leq 10$$

Since this case will always be true, i.e. $2 \leq 10$,

x can take all the values between -1 and -3 , $(-1, -2, -3)$

So, from all the above values, we can say that maximum value x can take is 3 and minimum value x can take is -7

$$\text{Number of values } x \text{ can take} = [-7, 3] = 11$$

55. There are 20 questions in a paper. Three marks are awarded for each right answer, 1 mark is deducted for each wrong answer and 0.5 is deducted for each unattempted question. Keshav has scored net zero marks with maximum accuracy possible. Accuracy is the ratio of number of questions answered correct to the total number of questions attempted. Find the number of questions attempted by Keshav.

Sol. Let number of questions answered correctly be R , number of questions answered incorrectly be W and number of unattempted questions be U

$$3R - W - 0.5U = 0$$

$$R + W + U = 20$$

$$W = 20 - U - R$$

$$3R = 20 - U - R + 0.5U$$

$$4R = 20 - 0.5U$$

(i) For $U = 0, R = 5, W = 15$ - Accuracy = $\frac{5}{20} \times 100 = 25\%$

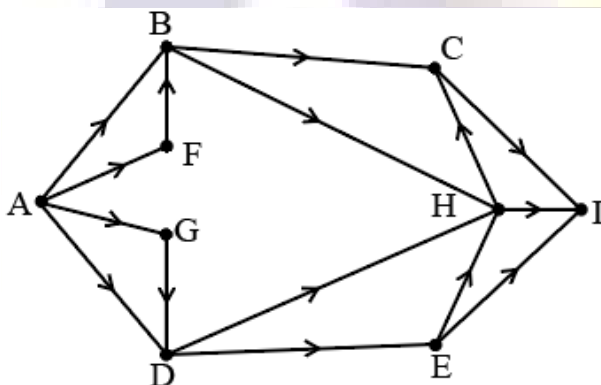
(ii) For $U = 8, R = 4, W = 8$ - Accuracy = $\frac{4}{12} \times 100 = 33.33\%$

(iii) For $U = 16, R = 3, W = 1$ - Accuracy = $\frac{3}{4} \times 100 = 75\%$

Accuracy is maximum in case (iii)

Therefore, number of question attempted = $3 + 1 = 4$

56. Rahul has a route map to reach I from A. What is the probability of Rahul choosing to reach I not through E





- A. $\frac{3}{8}$
- B. $\frac{3}{7}$
- C. $\frac{4}{7}$
- D. $\frac{5}{8}$

Sol. To reach I, Rahul has to go through C, H or E

There is only one way to reach I from C i.e C-I

Number of ways to reach C from A is two (A-B-C, A-F-B-C)

Total number of ways to reach I via C = $2*1 = 2$ ways

There are two ways to reach I from H (H-I, H-C-I)

Number of ways to reach H from A is 4 (A-B-H, A-F-B-H, A-G-D-H, A-D-H)

Total number of ways to reach I via H = $4*2 = 8$ ways

There are three ways to reach I via E (E-I, E-H-I, E-H-C-I)

Number of ways to reach E from A is 2 (A-D-E, A-G-D-E)

Total number of ways to reach I via E = $2*3 = 6$ ways

Total number of ways to reach I from A = $2 + 8 + 6 = 16$ ways

Probability of Rahul choosing to reach I not via E = $\frac{16-6}{16} = \frac{5}{8}$

Answer is option D.

57. In a 1000m race, A beats B by 100m and B beats C by 100m. In another 1000m race between C and D, where D's speed is half of A's speed, by how much distance(approximately) does C beat D?

- A. 325m
- B. 383m
- C. 375m
- D. 615m

Sol. We are given that A beats B by 100m and B beats C by 100m. Thus, A would beat C by 190m, as shown in the table.

A	B	C
1000	900	-
-	1000	900
1000	900	810

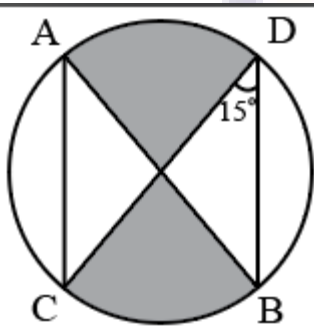
Since, for a constant time, speed is directly proportional to the distance travelled, Speeds of A, B and C are in the ratio of 100:90:81.

Now, D's speed is half that of A's speed. Thus, the ratio of the speed of C to the speed of D = 81:50.

When C covers 1000m, D will cover = $1000 \times \frac{50}{81} = 617.28 = 617(\text{approx.})$

Thus, C will beat D by 383m and hence, option B is the answer.

58. AB and CD are diameters of circle and radius of circle is 21 cm. Find the area of the shaded region (in sq cm) if $\angle CDB = 15^\circ$



Assume that $\pi = \frac{22}{7}$

Sol. AB and CD are diameters of circle. Intersecting point of two diameters is a centre of circle
Let the point of intersection i.e centre be 'O'

CO = OD = radius of circle = 21 cm

AO = OB = 21 cm

$\angle CDB = 15^\circ$, $\angle DBA = 15^\circ$

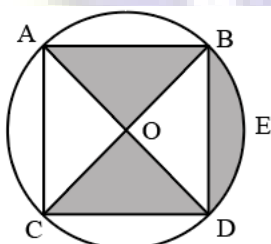
$\angle BOD = 180 - 15 - 15 = 150$

$\angle COB = 180 - 150 = 30^\circ$

Similarly we get, $\angle AOC = 150^\circ$ and $\angle AOD = 30^\circ$

Area of shaded region = $\frac{60}{360} \times \pi (21)^2 = \frac{1}{6} \times \frac{22}{7} \times 21 \times 21 = 231 \text{ cm}^2$

59. Given figure constitutes a square with side $14\sqrt{2}$ cm. AB and CD are diagonals of square. Find the area of shaded region





Assume that $\pi = \frac{22}{7}$

- A. 252 cm²
- B. 126 cm²
- C. 112 cm²
- D. 140 cm²

Sol. Area of shaded region BED = $\frac{1}{4}$ (area of circle - area of square)

Radius of circle = 14 cm

$$\begin{aligned} \text{Area of shaded region BED} &= \frac{1}{4} (\text{area of circle} - \text{area of square}) \\ &= \frac{1}{4} \left(\frac{22}{7} \times 14 \times 14 - (14\sqrt{2})^2 \right) \\ &= \frac{1}{4} (616 - 392) = \frac{224}{4} = 56 \end{aligned}$$

Area of triangle ABO + Area of triangle COD = $\frac{1}{2}$ (area of square) = 196

Required area = 196 + 56 = 252 cm²

Answer is option A.

60. x, y and z are single digit natural numbers such that the number 1x3y782z is divisible by 11. Find number of values x, y, z can take given $x \geq 3$, $y \geq 4$ and $z \geq 5$

Sol. For a number to be divisible by 11, difference of sum of alternate digits should be divisible 11

$$(x + y + 8 + z) - (1 + 3 + 7 + 2) = 0 \text{ or } 11n$$

x + y + z can be equal to 5, 16 or 27

It is given $x \geq 3$, $y \geq 4$ and $z \geq 5$, this implies $x + y + z \neq 5$

x + y + z = 16 for $x \geq 3$, $y \geq 4$ and $z \geq 5$

x + y + z = 4 for $x \geq 0$, $y \geq 0$ and $z \geq 0$

Number of values x, y, z can take in any order = $4 + 3 - 1_{C_{3-1}} = 6C_2 = 15$

x + y + z = 27 for $x \geq 3$, $y \geq 4$ and $z \geq 5$

Only possibility is x = 9, y = 9 and z = 9

Total number of values x, y, z can take = 1 + 15 = 16



61. Ramlal had some gold coins in his jewellery store. He gave two of these coins to his sons, sold a third of the total coins at a profit of 50% and the remaining at a profit of 20%, thus, earning an overall profit of 20%. If, instead, he had sold all the available coins, with 12 of them at 50% profit and the remaining at a loss of 25%, what would be the overall profit earned?

- A. 12.5%
- B. 0%
- C. 17.85%
- D. 27.5%

Sol. Let the total number of coins made be 'N'.

Ramlal gave 2 coins to his sons, sold $\frac{N}{3}$ coins at 50% profit and remaining coins, let's say x, at a profit of 20%.

$$\text{Thus, } N = 2 + \frac{N}{3} + x$$

$$x = \frac{2N}{3} - 2$$

Let the price of one gold coin be Rs. 1.

$$\text{Thus, } \left[\frac{N}{3}\right] \times 1.5 + \left[\frac{2N}{3} - 2\right] \times 1.2 = 1.2N$$

$$0.5N + 0.8N - 2.4 = 1.2N$$

$$N = 24$$

Thus, the total cost price = $24 \times 1 = \text{Rs. } 24$

Now, 12 coins are sold at 50% profit and 12 at a loss of 25%.

$$\text{Selling price} = 12 \times 1.5 + 12 \times 0.75 = 18 + 9 = 27$$

$$\text{Thus, profit} = \frac{(27 - 24) \times 100}{24} = 12.5\%$$

Hence, the answer is option A.

62. P and Q start running towards each other from points A and B, respectively. They meet at point C. After their meeting, P takes 9 minutes to reach B, and Q takes 4 minutes to reach A. If P and Q were running a 300m race, find out who would win and by how many metres?

- A. P, 100m
- B. Q, 200m
- C. Q, 100m
- D. P, 200m



Sol. P and Q reach point C at the same point, thus

$$\frac{AC}{P} = \frac{BC}{Q} \quad \rightarrow \quad \frac{P}{Q} = \frac{AC}{BC} \quad \dots(1)$$

P takes 9minutes and Q takes 4minutes to reach B and A, respectively.

Thus,

$$\frac{BC}{P} = 9 \quad \rightarrow \quad BC = 9P \quad \dots(2)$$

$$\frac{AC}{Q} = 4 \quad \rightarrow \quad AC = 4Q \quad \dots(3)$$

From 1, 2 and 3

$$\frac{P}{Q} = \frac{4Q}{9P}$$

$$\left(\frac{P}{Q}\right)^2 = \frac{4}{9}$$

$$\frac{P}{Q} = \frac{2}{3}$$

Thus, Q is faster than P.

Now, in a 300m race, Q will win. When Q completes 300m, P completes $300 \times \frac{2}{3} = 200\text{m}$.

Thus, Q beats P by 100m.

Hence, option C is the answer.

63. In a manufacturing plant of Holdeeram's foods, a worker can pack a box of sweets in 50 seconds. The brand is launching a new sweets product with new packaging that takes 50% more time to pack. If 45 workers with the same efficiency are on the packaging duty, how much time will it take to package 9000 boxes of the new product?

- A. 3hrs 50mins
- B. 4hrs
- C. 4hrs 10mins
- D. 4hrs 15mins

Sol. The new product takes 50% more time to pack than the existing product. Thus, the time required for packaging the new product = $1.5 \times 50 = 75$ secs

9000 such boxes can be packaged in 9000×75 secs.

Time required by 45 workers to package 9000 boxes = $\frac{9000 \times 75}{45} = 15000$ secs = 4hrs 10 mins

Hence, option C is the answer.

64. Aman sets off on his bike from Hyderabad to Nagpur at a certain speed, intending to reach Nagpur by 9 p.m. After covering a certain distance, he realises that he would be able to cover only five-eighth of the intended distance by 9 p.m. He, therefore, increases his speed by 75% and reaches Nagpur at 9 p.m. What percentage of the total distance did he cover at his initial speed?

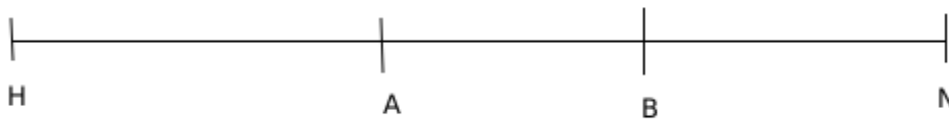
- A. 42%
- B. 27.5%
- C. 12.5%
- D. 15%

Sol. Let the total distance between Hyderabad (H) and Nagpur (N) be $8x$.

Let the initial speed of Aman be $4S$

Therefore increased speed of Aman will be $7S$.

Let the point where he increased his speed, be A and B be the point on HN such that $HB = \frac{5}{8}(HN) = 5x$, as shown below:



If he had travelled at $4S$, he would be at B by 9 p.m. But, after point A, he actually travels at a speed of $7S$ and reaches N at 9 p.m.

So, $\frac{AB}{AN} = \frac{4}{7}$ (As distance is directly proportional to speed if the time is constant)

Let $AB = 4y$ and $AN = 7y$

Then $BN = 3x = 7y - 4y$

or, $x = y$

So, $AB = 4x$ and $AN = 7x$

Therefore, $HA = x$

Hence by the time he changed his speed, he had covered x of $\frac{1}{8}$ th of the total distance, which is equivalent to 12.5 per cent of the total distance.

Alternate solution:

Let the total distance between Hyderabad (H) and Nagpur (N) be $8x$.

Let the initial speed of Aman be $4S$

Therefore increased speed of Aman will be $7S$.

Let the distance travelled by Aman at the initial speed be d .

$$\text{Thus, } \frac{5x}{4S} = \frac{d}{4S} + \frac{8x-d}{7S}$$

$$7(5x - d) = 4(8x - d)$$

$$d = x$$

Thus, Aman travels $\frac{x}{8x} = \frac{1}{8} = 12.5\%$ of the total distance at his initial speed.



65. If p, q are roots of equation $8x^2 - 30x + 27 = 0$ and p, r are roots of equation $14x^2 - 13x - 12 = 0$, then find the quadratic equation whose roots are $8q$ and $56r$

- A. $2x^2 + 14x - 576 = 0$
- B. $2x^2 - 14x - 576 = 0$
- C. $x^2 - 14x - 676 = 0$
- D. $x^2 + 14x - 576 = 0$

Sol. p, q are roots of equation $8x^2 - 30x + 27 = 0$

$$p + q = \frac{15}{4}$$

$$pq = \frac{27}{8}$$

p, r are roots of equation $14x^2 - 13x - 12 = 0$

$$p + r = \frac{13}{14}$$

$$pr = -\frac{12}{14}$$

$$q - r = \frac{79}{28} \dots\dots (1)$$

$$\frac{q}{r} = \frac{-63}{16} \dots\dots (2)$$

Solving (1) and (2), we get

$$r = -\frac{4}{7}, q = \frac{9}{4}$$

$$8q = 18 \text{ and } 56r = -32$$

$$\text{sum of roots} = 18 + (-32) = -14$$

$$\text{product} = -576$$

$$\text{Quadratic equation: } x^2 + 14x - 576 = 0$$

Answer is option D.

66. $S = -\frac{1}{2} + \frac{1}{10} + \frac{1}{40} + \frac{1}{88} + \dots\dots + 21 \text{ terms} = -\frac{n}{m}$. If m and n are co prime natural numbers, find m - n

Sol. $S = -\frac{1}{2} + \frac{1}{10} + \frac{1}{40} + \frac{1}{88} + \dots\dots + 21 \text{ terms}$

$$S = \frac{1}{3} \left(\frac{3}{(-1)(2)} + \frac{3}{(2)(5)} + \frac{3}{(5)(8)} + \dots\dots + \frac{3}{(59)(62)} \right)$$

$$S = \frac{1}{3} \left(\frac{2-(-1)}{(-1)(2)} + \frac{5-2}{(2)(5)} + \frac{8-5}{(5)(8)} + \dots\dots + \frac{62-59}{(59)(62)} \right)$$

$$S = \frac{1}{3} \left(\frac{1}{-1} - \frac{1}{2} + \frac{1}{2} - \frac{1}{5} + \frac{1}{5} - \frac{1}{8} + \dots\dots + \frac{1}{59} - \frac{1}{62} \right)$$

$$S = \frac{1}{3} \left(-1 - \frac{1}{62} \right)$$

$$S = -\frac{21}{62}$$

$$n = 21 \text{ and } m = 62$$

$$m - n = 62 - 21 = 41$$