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Scorecard (procreview.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Accuracy (AccSelectGraph.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Qs Analysis (QsAnalysis.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Booster Analysis (BoosterAnalysis.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Video Attempt (VideoAnalysis.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Solutions (Solution.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Bookmarks (Bookmarks.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

Toppers (Toppers.jsp?sid=aaaFOuj1h2PZo7o7VNG6wSat Jan 11 21:03:28 IST 2020&qsetId=EiPjzOoXkhI=&qsetName=Mock CAT − 06 2019)

VARC

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Sec 1

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This strategy helps mitigate a great struggle of SETI to date: the natural tension between making assumptions about what you are looking for so that you can search efficiently, balanced against the intuition that our definition of 'technology' is very nascent indeed and so the less we assume the better.

The AI anomaly engine assumes only that the activities of an alien civilization might have some detectable effect on our observable universe. Best of all, the anomaly engine is a win-win proposition: Even if a strange observation has nothing to do with alien technology, it demands an explanation that could expand our understanding of the natural universe.

For example, in the early morning of July 25, 2001, a powerful burst of radio energy, less than 5 milliseconds in duration, swept through the Solar System and washed over the Southern Hemisphere of Earth. This extraordinary event went unnoticed for more than six years. It was not until November 2007 that astronomer Duncan Lorimer and his research student stumbled across the evidence for this intense spike of radio energy. The evidence had been hiding in plain sight among the mountains of archived data from the Parkes radio telescope in Australia. Perhaps an AI anomaly engine could have found the evidence for these fast radio bursts much sooner. And what is more important, there may be other surprises that human eyes have missed that are still waiting to be uncovered in data archives.

Indeed, as the capabilities of AI improve, new computer applications, such as deep-learning models, are expected to intelligently isolate similar anomalies within the huge data archives that have been collected across space science disciplines.

However, anomaly detection within multivariant data remains a dark art for even the best human experts, so developing an intelligent and flexible anomaly engine will be no easy feat. One approach is to train a deep neural network to be an 'autocorrelator' that finds unusual examples of data. The input data must be compressed down to flow through a pinch-point in the neural net, like sand flowing through the waist of an hourglass. The more often this AI system is shown data of a similar nature, the better it becomes at compressing and accurately restoring the information. But if it is shown data that are unusual in some way, output would be poorly replicated and could be flagged as anomalous.

The problem is that these simple autocorrelators work best within a narrow domain of data and still lack the broad flexibility we need. However, AI research is making great strides forward. Could it be that, waiting within the petabytes of space observational data we have already collected, is the unnoticed evidence that we've had company all along?

Q.1
As per the author, how has the new SETI strategy changed from the existing ones?

1 ○ Unlike the current SETI strategies, the new one doesn't make any assumption.

2 ○ The new strategy has shifted the focus from searching for the expected to looking for the unexpected.

3 ○ The existing strategies focus on searching for signals that aliens are trying to communicate with us; however, the new strategy knows that the aliens are going about their own business.

4 ○ The current strategies have focused too much by relying on existing space data to look for recognizable pattern whereas the new strategy focuses on looking for a wider use of the data.

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Q.2
The author gives the example of the powerful burst of radio energy in order to:

1 ○ lament the fact that such a significant event had gone completely unnoticed for so long.

2 ○ **show how sometimes what we are looking for remains hidden in plain sight.**

3 ○ **assert the fact that the new SETI technology can only win and never lose.**

4 ○ **highlight how the search for anomalies can benefit us in unexpected ways.**

FeedBack

🔖 **Bookmark**

🔑 **Answer key/Solution**

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Q.3
Which of the following best describes the organization of the passage?

1 ○ The restrictions of an existing technology are mentioned followed by the discussion of an alternative.

2 ○ The detailed definition of a conceptually nascent technology is followed by a hypothetical analysis of its utility.

3 ○ The limitations of a new technology are analysed and the conclusion asserts suggestions for future researchers.

4 ○ The practical utility of an unexpected usage of a new technology is criticised and the conclusion exhorts researchers to look for a more suitable alternative.

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Q.4

Which of the following is the main challenge of the new SETI technology?

1 ○ The dark art of anomaly detection within multivariant data

2 ○ **The development of an intelligent and flexible engine**

3 ○ **The lack of expansive elasticity of the autocorrelators**

4 ○ **The unavailability of a pin-point neural net**

FeedBack

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Q.5
Why is the anomaly engine a win-win proposition?

1 ○ As it can find even the tiniest of significant data from observing the universe

2 ○ As it will broaden our understanding of the universe

3 ○ As it can help us balance our intuition against our expectations

4 ○ As it will reveal all mysterious findings that we have neglected so far

Direction for questions (6-10): Read the given passages and answer the questions that follow.

Scientists have discovered massive mountains in the Earth's mantle, an advance that may change our understanding of how the planet was formed. Most school children learn that the Earth has three layers: a crust, mantle and core, which is subdivided into an inner and outer core.

While that is not wrong, it does leave out several other layers that scientists have identified within the Earth.

In a study published in the journal 'Science', scientists used data from an enormous earthquake in Bolivia to find mountains and other topography on a layer located 660 km straight down, which separates the upper and lower mantle.

Lacking a formal name for this layer, the researchers simply call it "the 660-km boundary."

To peer deep into the Earth, scientists from the Princeton University in the U.S. and the Institute of Geodesy and Geophysics in China, used the most powerful waves on the planet, which are generated by massive earthquakes.

Data from earthquakes that are magnitude 7.0 or higher send out shockwaves in all directions that can travel through the core to the other side of the planet — and back again.

For this study, the key data came from waves picked up after a magnitude 8.2 earthquake — the second-largest deep earthquake ever recorded — that shook Bolivia in 1994.

Scientists used powerful computers to simulate the complicated behaviour of scattering waves in the deep Earth.

The technology depends on a fundamental property of waves: their ability to bend and bounce.

Just as light waves can bounce (reflect) off a mirror or bend (refract) when passing through a prism, earthquake waves travel straight through homogenous rocks but reflect or refract when they encounter any boundary or roughness.

"We know that almost all objects have surface roughness and therefore scatter light," said Wenbo Wu, who was at Princeton at the time of the study.

"That's why we can see these objects -- the scattering waves carry the information about the surface's roughness," said Wu, who is now a postdoctoral researcher at the California Institute of Technology in the US. "In this study, we investigated scattered seismic waves traveling inside the Earth to constrain the roughness of the Earth's 660-km boundary," Wu said.

The researchers were surprised by just how rough that boundary is — rougher than the surface layer that we all live on.

"In other words, stronger topography than the Rocky Mountains or the Appalachians is present at the 660-km boundary," said Wu.

Their statistical model did not allow for precise height determinations, but there's a chance that these mountains are bigger than anything on the surface of the Earth.

The roughness was not equally distributed, either; just as the crust's surface has smooth ocean floors and massive mountains, the 660-km boundary has rough areas and smooth patches.

The researchers also examined a layer 410 km down, at the top of the mid-mantle "transition zone," and they did not find similar roughness. The presence of roughness on the 660-km boundary has significant implications for understanding how our planet formed and evolved.

Q.6
As per the passage, which of the following is not true about the '660-km boundary'?

1 ○ **It is rougher than the surface layer we live on.**

2 ○ **It has uneven distribution of smooth patches.**

3 ○ **It contains mountains that are surely bigger than any mountain on Earth.**

4 ○ **It separates the upper and lower mantle, and it is located in Bolivia.**

FeedBack

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Q.7
All of the following can be inferred from the passage except:

1 ○ our understanding of the composition of the surface inside Earth is likely to change.

2 ○ the largest ever earthquake captured on Earth surface has a magnitude of more than 8.2.

3 ○ an earthquake of a magnitude greater than 7 is quite helpful in making us explore the core of Earth.

4 ○ the behaviour of waves inside the Earth's core can be studied by computers.

FeedBack

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Q.8
Which of the following best captures the main idea of the passage?

1 ○ **The core of Earth is full of mysteries that we are yet to explore.**

2 ○ **The advent of new technology has revolutionized our understanding of the origin and evolution of the layers on Earth.**

3 ○ **A new study has challenged traditional notions about the formation and evolution of the Earth surface.**

4 ○ **A new study has revealed certain unknown facets about the Earth's layers and their compositions.**

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Q.9
The author gives the example of light waves in order to:

1 ○ explain how the research studies the complicated behaviour of scattering waves in the deep Earth.

2 ○ show their superior reliability quotient when it comes to understanding earthquakes.

3 ○ compare and contrast these with the fundamental properties of waves.

4 ○ explain how Earth is essentially a prism as it contains most of the reflective and refractive properties of a prism.

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To peer deep into the Earth, scientists from the Princeton University in the U.S. and the Institute of Geodesy and Geophysics in China, used the most powerful waves on the planet, which are generated by massive earthquakes.

Data from earthquakes that are magnitude 7.0 or higher send out shockwaves in all directions that can travel through the core to the other side of the planet — and back again.

For this study, the key data came from waves picked up after a magnitude 8.2 earthquake — the second-largest deep earthquake ever recorded — that shook Bolivia in 1994.

Scientists used powerful computers to simulate the complicated behaviour of scattering waves in the deep Earth.

The technology depends on a fundamental property of waves: their ability to bend and bounce.

Just as light waves can bounce (reflect) off a mirror or bend (refract) when passing through a prism, earthquake waves travel straight through homogenous rocks but reflect or refract when they encounter any boundary or roughness.

"We know that almost all objects have surface roughness and therefore scatter light," said Wenbo Wu, who was at Princeton at the time of the study.

"That's why we can see these objects -- the scattering waves carry the information about the surface's roughness," said Wu, who is now a postdoctoral researcher at the California Institute of Technology in the US. "In this study, we investigated scattered seismic waves traveling inside the Earth to constrain the roughness of the Earth's 660-km boundary," Wu said.

The researchers were surprised by just how rough that boundary is — rougher than the surface layer that we all live on.

"In other words, stronger topography than the Rocky Mountains or the Appalachians is present at the 660-km boundary," said Wu.

Their statistical model did not allow for precise height determinations, but there's a chance that these mountains are bigger than anything on the surface of the Earth.

The roughness was not equally distributed, either; just as the crust's surface has smooth ocean floors and massive mountains, the 660-km boundary has rough areas and smooth patches.

The researchers also examined a layer 410 km down, at the top of the mid-mantle "transition zone," and they did not find similar roughness. The presence of roughness on the 660-km boundary has significant implications for understanding how our planet formed and evolved.

Q.10
The author uses the phrase 'the researchers simply call it "the 660-km boundary' in order to:

1 ○ highlight the helplessness of the scientists who couldn't give it a formal name.

2 ○ showcase the nonchalance of the researchers who didn't bother to give the area a formal name.

3 ○ stress on our lack of awareness regarding the presence of other layers inside Earth.

4 ○ explain how sometimes scientists try to simplify the naming process by not opting for a formal name.

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🔑 Answer key/Solution

Direction for questions (11-15): Read the given passages and answer the questions that follow.

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Aphantasia could possibly affect how students revise for exams, too. Using mind maps is one common strategy, which has been shown to effectively help them retain and recall information, and merely visualising the appropriate page of their revision notes can also help them to recall the information on it. It follows, then, that an inability to create mental images would hinder students' abilities to use such strategies.

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For example, are people with aphantasia able to imagine sounds or touch sensations, or does the condition affect imagery in senses other than vision? Galton alluded to this in his original 1880 paper, concluding that "the missing faculty seems to be replaced so serviceably by other modes of conception... Men who declare themselves entirely deficient in the power of seeing mental pictures can nevertheless give life-like descriptions of what they have seen."

Regardless, research into visual imagery would seem to suggest that students with aphantasia are likely to experience difficulties with learning, but as yet there is no research confirming that this is the case.

"We know that children with aphantasia tend not to enjoy descriptive texts, and this may well influence their reading comprehension," says neurologist Adam Zeman of the University of Exeter who, together with his colleagues, gave the condition its name last year. "But there isn't any evidence directly linking it to learning disabilities yet."

Zeman adds that people with aphantasia may be able to form visual images, but just don't have conscious access to them. "The story really is still at the early stages, so the implications for education haven't been explored," he says.

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Thus, it may be possible to objectively measure individual differences or variations in the vividness of people's mental images, and to identify students who have aphantasia. If it becomes clear that the condition does in fact impinge on children's ability to learn, it may then be possible to devise alternative learning strategies for them.

Q.11
Which of the following best summarizes the passage?

1 ○ A learning disability is explained in detailed manner.

2 ○ A physical condition is described and its detrimental effects have been explained.

3 ○ A possible set of solutions to a problem that has the potential to turn into a learning disability has been explained.

4 ○ A neurological condition has been explained with respect to its possible effect on learning abilities.

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Q.12
Which of the following is not true about aphantasics?

1 ○ They show a dislike for reading descriptive texts.

2 ○ They are unable to experience any form of visual imagery.

3 ○ They are likely to struggle while revising for exams.

4 ○ They are yet to be categorized as people suffering from learning disabilities.

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Q.13

According to the passage, aphantasia can affect children in all of the following areas except:

1 ○ **The ability to create mind maps**

2 ○ **The ability to grasp abstract concepts**

3 ○ **The ability to become intelligent**

4 ○ **The ability to adopt some strategies to revise**

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Q.14
As per the passage, the answer to which of the following questions is most crucial with respect to understanding aphantasia?

1 ○ Is the person suffering from this condition able to form imagery which is not visual?

2 ○ Does it have any possibility of affecting the overall intelligence of children?

3 ○ Does it affect organs other than the brain?

4 ○ Is the person suffering from this condition able to give life-like descriptions of what he has seen?

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Q.15
As per the passage, which of the following best describes the relationship between mental imagery and literacy skills?

1 ○ Both are mutually incompatible.

2 ○ The absence of the latter proves the presence of the former.

3 ○ Both are mutually dependent for being effective.

4 ○ The lack of the former affects the proficiency in the latter.

Direction for questions (16-19): Read the given passages and answer the questions that follow.

Poetry is a kind of "saying." It is, however, a kind that many people, until they become well acquainted with it, feel is rather peculiar and even useless. They feel this way for two reasons: the "way of the saying" and the "nature of the said". As for the "way of the saying," the strongly marked rhythms, the frequent appearance of rhyme, and the figurative language may seem odd and distracting; and as for the "nature of the said," it generally contains neither a good, suspenseful story nor obviously useful information. Poetry, in short, may seem both unnatural and irrelevant.

Yet poetry has existed from the time of the emergence of human race from shadowy prehistory and has survived, in one form or another, in every society since that time. When we realize this, we may be inclined to consider the possibility that poetry only 'seems' unnatural and irrelevant. We may even decide, on reflection, that it does spring from deep human impulses and does fulfil human needs.

Let us look first at the way of the saying. Probably its most obvious feature is its strongly marked rhythm. Rhythm is, we know, the repetition in time of a perceptible pattern. The pattern may be visual, as in the flashing of a light or the advance and retreat of waves on the beach, or it may be a pattern of repetition not in time but in space – we sometimes even speak of the rhythmic elements in a scene or a painting. In poetry, however, we are characteristically concerned with aural rhythm, that of sound. Aural rhythm is most obvious and assertive in the ticking of a clock or a metronome, but we are commonly aware of many more vital rhythms around us – in the sound of insects on a summer night, in a pulse beat, in a human voice. In fact, the world we live in pulses with rhythms of all kinds – visual, aural, tactile: the procession of the seasons, the wax and wane of the moon, the pattern of tides, the migration of birds. The human body itself is a locus of rhythms: the beat of the heart, the inhalation and exhalation of breath, waking and sleeping, effort and rest, hunger and satiety.

Rhythm is a principle of all life and all activity and is, of course, deeply involved in the experience of, and the expression of, emotion. We all know how the expressions, verbal or other, of love, hate, pain, joy, or grief tend to fall into rhythmic patterns; the very origin of language involves rhythm.

Q.16
Which of the following statements best captures the author's opinion on poetry?

1 ○ It has been a part of the civilised society in a practically useful form.

2 ○ It can't survive without visual, aural, and tactile rhythms.

3 ○ It has been deemed useless due to the lack of comprehension among the masses.

4 ○ It has been part of every society since prehistoric times and thus is neither peculiar nor impractical.

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Q.17
As per the author, why can poetry seem unnatural and irrelevant?

1 ○ Because even those who are proficient in it feel it is peculiar and useless.

2 ○ Because it highlights the inherent contradiction between 'the way of the saying' and 'the nature of the said'.

3 ○ Because it is distracting as it actually originates in deep human impulses.

4 ○ Because its diction is unfamiliar and its usefulness is not obvious.

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Q.18
Which of the following is the main purpose of the penultimate paragraph of the passage?

1 ○ To highlight the importance of bodily rhythms

2 ○ To showcase the ubiquity of aural rhythms

3 ○ To describe the importance of poetic language via rhythms

4 ○ To explain the difference between the different types of rhythms

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Let us look first at the way of the saying. Probably its most obvious feature is its strongly marked rhythm. Rhythm is, we know, the repetition in time of a perceptible pattern. The pattern may be visual, as in the flashing of a light or the advance and retreat of waves on the beach, or it may be a pattern of repetition not in time but in space – we sometimes even speak of the rhythmic elements in a scene or a painting. In poetry, however, we are characteristically concerned with aural rhythm, that of sound. Aural rhythm is most obvious and assertive in the ticking of a clock or a metronome, but we are commonly aware of many more vital rhythms around us – in the sound of insects on a summer night, in a pulse beat, in a human voice. In fact, the world we live in pulses with rhythms of all kinds – visual, aural, tactile: the procession of the seasons, the wax and wane of the moon, the pattern of tides, the migration of birds. The human body itself is a locus of rhythms: the beat of the heart, the inhalation and exhalation of breath, waking and sleeping, effort and rest, hunger and satiety.

Rhythm is a principle of all life and all activity and is, of course, deeply involved in the experience of, and the expression of, emotion. We all know how the expressions, verbal or other, of love, hate, pain, joy, or grief tend to fall into rhythmic patterns; the very origin of language involves rhythm.

Q.19
As per the passage, all of the following are true about rhythm except:

1 ○ It can be visual as well as aural.

2 ○ It gives a focus to the human body and its organs.

3 ○ Aural rhythm is the most common feature of poetry.

4 ○ It was part of the origin of language.

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🔍 **Answer key/Solution**

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Q.20
Which of the following confirmed Russia's suspicion of collusion?

1 ⚪ **The statement made by Maria Zakharova**

2 ⚪ **The accusation levelled at Russia by Zoran Zaev**

3 ⚪ **The US department's support for the statements made by the foreign ministry of Greece**

4 ⚪ **The tweet of the US department where it praises Sergey V. Lavrov who noted Greece's opposition to sanctions against Russia**

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🔑 Answer key/Solution

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Q.21
Which of the following best captures the relationship between Russia and Greece as described in the passage?

1 ○ **They have been traditional allies who are now going through a tense phase.**

2 ○ **They were friends who have now turned foes.**

3 ○ **They have been traditional allies who managed to overcome stiff opposition even when Athens was a bastion of western civilization.**

4 ○ **They were once friends but now it is unlikely that Greece will ever support Russia in any diplomatic matter.**

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🔑 Answer key/Solution

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Q.22
Why does the author say that the Greek move was unexpected?

1 ○ **Because traditionally Greece had always supported Russia.**

2 ○ **Because even during cold war, Greece had maintained a channel of communication with Russia.**

3 ○ **Because even recently, Russia was full of praise for Greece and didn't show any sign of anticipation of the troubles.**

4 ○ **Because Greece has its strongest pro-Russia government.**

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Q.23
Which of the following can be inferred from the passage?

1 ○ **Before this, Russia had never meddled in Greek's affairs.**

2 ○ **Russia's interest in the Balkans predates the current dispute with Greece.**

3 ○ **The Greek domestic policy has undergone a paradigm shift in recent years.**

4 ○ **The Greek and the Macedonian government have come to an agreement which is supported by all parties in the two nations.**

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Q.24
What has been termed disappointing by Andrey Maslov?

1 ○ The way Greece supported the western nations in sanctions against Russia over the poisoning of a former intelligence officer

2 ○ The expulsion of two Russian diplomats by Greece over Macedonia

3 ○ The threat made to Russia by Greece over the independence of Macedonia

4 ○ The sanctions levied against Russia by the UN which was supported by Greece

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Q.25

Directions for question (25): The four sentences (labelled 1, 2, 3, and 4) given in this question, when properly sequenced, form a coherent paragraph. Decide on the proper order for the sentences and key in this sequence of four numbers as your answer.

1. Criticism has plucked the imaginary flowers from the chain, not so that man will wear the chain without any fantasy or consolation but so that he will shake off the chain and cull the living flower.
2. The demand to give up the illusions about its condition is the demand to give up a condition that needs illusions.
3. The abolition of religion as the illusory happiness of the people is required for their real happiness.
4. The criticism of religion is therefore in embryo the criticism of the vale of woe, the halo of which is religion.

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Q.26

Directions for question (26): 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 difficulty is caused by the fact that the behavior of robotic and AI systems is "emergent".
2. Moreover, the programming and algorithms used by robots and AI entities may be the work of many hands, and may employ generative technologies that allow innovation at multiple layers.
3. The first problem is how to distribute rights and responsibilities among human beings when non-human agents create benefits like artistic works or cause harms like physical injuries.
4. So, lawyers should identify the "essential characteristics" of robotics and then ask how the law should respond to the problems posed by those essential characteristics.
5. Their actions may not be predictable in advance or constrained by human expectations about proper behaviour.

Q.27

Directions for question (27): The four sentences (labelled 1, 2, 3, and 4) given in this question, when properly sequenced, form a coherent paragraph. Decide on the proper order for the sentences and key in this sequence of four numbers as your answer.

1. As you are, you can understand philosophy -- but not tantra.
2. If you can understand language, if you can understand concept, you can understand philosophy.
3. You will need a change... rather, a mutation.
4. You need not change; you require no transformation.

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Q.28

Directions for question (28): 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. A microbe found in sewage seems far less common in these areas than elsewhere, although it's not yet clear why.
2. In seawater off of four islands near Sulawesi in Indonesia, researchers monitored levels of Enterococcus-¬type bacteria, which can infect many animals, including people, fish, and invertebrates.
3. Although seagrass meadows are widespread, they have been declining at a rate of 7 percent per year since 1990 because of coastal development and destructive fishing practices.
4. Levels of potentially pathogenic bacteria were reduced by more than half at sites that had seagrass beds compared with sites lacking such beds.
5. Seagrass meadows protect coral reefs from the bacteria in untreated wastewater.

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Q.29

Directions for question (29): The four sentences (labelled 1, 2, 3, and 4) given in this question, when properly sequenced, form a coherent paragraph. Decide on the proper order for the sentences and key in this sequence of four numbers as your answer.

1. Genes passed down to some modern humans from ancestors who mated with Neanderthals around 50,000 years ago affect gene expression, according to a new study.
2. For each gene, the expression of each variant was compared in 52 different tissues.
3. In this study, researchers identified people who carried both a Neanderthal version and a modern-¬human version of any given human gene.
4. Previous studies had shown that Neanderthal genes were correlated with fat metabolism, depression, and lupus risk, but no one had yet looked for mechanisms behind these links.

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Answer key/Solution

Q.30

Directions for question (30): 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. A simple test for the performative is the possibility of adding 'hereby' in English before the verb, where 'hereby' means 'by uttering these words': 'We hereby declare our independence'.
2. It is in pronouncing these words that I promise, order, or marry.
3. Performative utterances do not describe but perform the action they designate.
4. I can't perform the act of walking by pronouncing certain words.
5. But once you allow for the existence of such 'implicit performatives', where there is no explicitly performative verb, you have to admit that any utterance can be an implicit performative.

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Answer key/Solution

Q.31

Directions for question (31): The four sentences (labelled 1, 2, 3, and 4) given in this question, when properly sequenced, form a coherent paragraph. Decide on the proper order for the sentences and key in this sequence of four numbers as your answer.

1. It is indeed heartening that 53 years after Independence, there is a growing awareness of the need to expose the rural population to the winds of change sweeping the urban centres of the country.
2. This is due to the simple reason that even today more than 75 per cent of the country's population living in rural areas is illiterate.
3. In this task of social, cultural and economic transformation, the electronic mass, particularly television, has a very important role to play.
4. The introduction of Panchayati Raj in some states is a step forward in bringing the otherwise backward rural population into the mainstream of national development.

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⚭ **Answer key/Solution**

Q.32

Directions for question (32): The passage given below is followed by four summaries. Choose the option that best captures the author's position.

The magic of the Hollywood style at its best (and of all the cinema which fell within its sphere of influence) arose, not exclusively, but in one important aspect, from its skilled and satisfying manipulation of visual pleasure. Unchallenged, mainstream films coded the erotic into the language of the dominant patriarchal order. In the highly developed Hollywood cinema, it was only through these codes that the alienated subject, torn in his imaginary memory by a sense of loss, by the terror of potential lack in phantasy, came near to finding a glimpse of satisfaction: through its formal beauty and its play on his own formative obsessions.

1 ○ Manipulation of visual pleasure has ushered in the best era in Hollywood.

2 ○ The magic of the Hollywood style is best reflected by the visual representation of the erotic language of the dominant patriarchal order.

3 ○ Like everything else in Hollywood, even the concept of fantasy is defined by the dominant patriarchal obsession.

4 ○ The Hollywood style became effective by intelligently manipulating visual pleasure for the audience.

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⚭ **Answer key/Solution**

Q.33

Directions for question (33): The passage given below is followed by four summaries. Choose the option that best captures the author's position.

In revolutionary situations, a single event can sometimes trigger the final leap from hesitation to irrevocable action. Such a moment came in January 1776 when a recent British immigrant, Thomas Paine, published an incendiary pamphlet, 'Common Sense', eloquently calling for independence. "Everything that is right or reasonable pleads for separation," Paine declared. "The blood of the slain, the weeping voice of nature cries, 'tis time to part." Appealing to the American sense of destiny, he proclaimed: "The cause of America is in great measure the cause of all mankind…"

1 ○ Thomas Paine paved the way for the independence of America by his incendiary speeches.

2 ○ America was built by the revolutionary writing of Thomas Paine, a recent British immigrant.

3 ○ The American struggle for independence found a boost in the shape of Thomas Paine's writing.

4 ○ Thomas Paine proves the point that in every revolution, a small step taken by a person proves catastrophically significant.

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Q.34

Directions for question (34): The passage given below is followed by four summaries. Choose the option that best captures the author's position.

Constantly reflect that all the things which happen now have happened before: reflect too that they will happen again in the future. Have in your mind's eye whole dramas with similar settings, all that you know of from your own experience or earlier history – for example, the whole court of Hadrian, the whole court of Antoninus, the whole court of Philip, Alexander, Croesus. All the same as now: just a different cast.

1 ○ Nothing essentially changes in the world; it's the same set of people who keep ruling.

2 ○ To understand life one must learn that history keeps repeating itself.

3 ○ The essential nature of humans never change; they keep coming back to earth with different bodies.

4 ○ One must understand that if one visualises historical events through one's mind's eye, one will be able to see that the same set of people have been responsible for all historical wrongs.

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Sec 2

Directions for questions 35 to 38: Answer the questions on the basis of the information given below.

Four students participated in a National Aptitude Test (NAT). The test had 4 rounds. In each round, a paper containing 10 questions was given to each of the students, where each question carried 1 mark for correct answer and no negative marking for incorrect or unattempted answer. Based on the marks scored by them in each round, each of them was given a rank in each round, where the one getting rank 1 scored the highest marks in that round and the one getting rank 4 scored the lowest. Student scoring the highest total marks i.e. the sum of marks scored in all the four rounds, would have won the NAT. The table given below shows the ranking of these 4 students in each of the 4 rounds.

	Round I	Round II	Round III	Round IV
A	1	4	1	1
B	2	3	3	4
C	3	1	4	3
D	4	2	2	2

Some additional information about the test is also known, which is as follows:

i. Total marks scored by B was more than that of A.
ii. Each of the students solved at least 1 question correctly in each of the four rounds.
iii. No two students scored same marks in any round.
iv. No two students got the same total marks.
v. A scored 10 marks in round IV.

Q.35
If A had the minimum possible marks in round I, then who won the National Aptitude Test (NAT)?

1 ◯ B

2 ◯ C

3 ◯ D

4 ◯ Cannot be determined

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Directions for questions 35 to 38: Answer the questions on the basis of the information given below.

Four students participated in a National Aptitude Test (NAT). The test had 4 rounds. In each round, a paper containing 10 questions was given to each of the students, where each question carried 1 mark for correct answer and no negative marking for incorrect or unattempted answer. Based on the marks scored by them in each round, each of them was given a rank in each round, where the one getting rank 1 scored the highest marks in that round and the one getting rank 4 scored the lowest. Student scoring the highest total marks i.e. the sum of marks scored in all the four rounds, would have won the NAT. The table given below shows the ranking of these 4 students in each of the 4 rounds.

	Round I	Round II	Round III	Round IV
A	1	4	1	1
B	2	3	3	4
C	3	1	4	3
D	4	2	2	2

Some additional information about the test is also known, which is as follows:

i. Total marks scored by B was more than that of A.
ii. Each of the students solved at least 1 question correctly in each of the four rounds.
iii. No two students scored same marks in any round.
iv. No two students got the same total marks.
v. A scored 10 marks in round IV.

Q.36
How many marks did D score in round II?

1 ○ 5

2 ○ 6

3 ○ 7

4 ○ 9

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Directions for questions 35 to 38: Answer the questions on the basis of the information given below.

Four students participated in a National Aptitude Test (NAT). The test had 4 rounds. In each round, a paper containing 10 questions was given to each of the students, where each question carried 1 mark for correct answer and no negative marking for incorrect or unattempted answer. Based on the marks scored by them in each round, each of them was given a rank in each round, where the one getting rank 1 scored the highest marks in that round and the one getting rank 4 scored the lowest. Student scoring the highest total marks i.e. the sum of marks scored in all the four rounds, would have won the NAT. The table given below shows the ranking of these 4 students in each of the 4 rounds.

	Round I	Round II	Round III	Round IV
A	1	4	1	1
B	2	3	3	4
C	3	1	4	3
D	4	2	2	2

Some additional information about the test is also known, which is as follows:

i. Total marks scored by B was more than that of A.
ii. Each of the students solved at least 1 question correctly in each of the four rounds.
iii. No two students scored same marks in any round.
iv. No two students got the same total marks.
v. A scored 10 marks in round IV.

Q.37
If B was the topper of NAT, then which of the following cannot be the marks of A in round I?

1 ○ 5

2 ○ 6

3 ○ 7

4 ○ All of these

Directions for questions 35 to 38: Answer the questions on the basis of the information given below.

Four students participated in a National Aptitude Test (NAT). The test had 4 rounds. In each round, a paper containing 10 questions was given to each of the students, where each question carried 1 mark for correct answer and no negative marking for incorrect or unattempted answer. Based on the marks scored by them in each round, each of them was given a rank in each round, where the one getting rank 1 scored the highest marks in that round and the one getting rank 4 scored the lowest. Student scoring the highest total marks i.e. the sum of marks scored in all the four rounds, would have won the NAT. The table given below shows the ranking of these 4 students in each of the 4 rounds.

	Round I	Round II	Round III	Round IV
A	1	4	1	1
B	2	3	3	4
C	3	1	4	3
D	4	2	2	2

Some additional information about the test is also known, which is as follows:

i. Total marks scored by B was more than that of A.
ii. Each of the students solved at least 1 question correctly in each of the four rounds.
iii. No two students scored same marks in any round.
iv. No two students got the same total marks.
v. A scored 10 marks in round IV.

Q.38
What is the maximum possible difference between the highest total score and the lowest total score?

Directions for questions 39 to 42: Answer the questions on the basis of the information given below.

First year students of MBA from IIM-Z, when asked for their preferences of departments in which they wished to complete their MBA, showed interest among these 4 departments - Sales (S), Marketing (M), Finance (F) and Human Resources (HR). The table shown below provides the information about the number of students showed interest in one or more of these four streams.

Category	Number of Students	Percentage of Girls
(F ∩ HR ∩ S) \ M	6	33.33
(M ∩ HR ∩ S) \ F	8	50
(S ∩ F ∩ M) \ HR	4	50
(HR ∩ M ∩ F) \ S	10	40
(HR ∩ S) \ (M ∪ F)	13	0
(S ∩ M) \ (F ∪ HR)	3	0
(M ∩ F ∩ S ∩ HR)	2	0
(M ∩ HR) \ (S ∪ F)	15	0
S \ (M ∪ F ∪ HR)	5	0
(F ∩ S) \ (HR ∪ M)	12	25
(F ∩ M) \ (S ∪ HR)	6	66.66
(HR ∩ F) \ (M ∪ S)	12	33.33
M \ (S ∪ F ∪ HR)	20	15
F \ (M ∪ S ∪ HR)	10	0
HR \ (M ∪ F ∪ S)	8	50

Some notations used in the above table are defined as:

A \ B implies all those members in A which are not in B.
A ∪ B implies all those members who are in either A or B or both.
A ∩ B implies all those members who are common in both A and B.

Q.39
Find the number of students interested in either sales or marketing or both.

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Answer key/Solution

Directions for questions 39 to 42: Answer the questions on the basis of the information given below.

First year students of MBA from IIM-Z, when asked for their preferences of departments in which they wished to complete their MBA, showed interest among these 4 departments - Sales (S), Marketing (M), Finance (F) and Human Resources (HR). The table shown below provides the information about the number of students showed interest in one or more of these four streams.

Category	Number of Students	Percentage of Girls
(F ∩ HR ∩ S) \ M	6	33.33
(M ∩ HR ∩ S) \ F	8	50
(S ∩ F ∩ M) \ HR	4	50
(HR ∩ M ∩ F) \ S	10	40
(HR ∩ S) \ (M ∪ F)	13	0
(S ∩ M) \ (F ∪ HR)	3	0
(M ∩ F ∩ S ∩ HR)	2	0
(M ∩ HR) \ (S ∪ F)	15	0
S \ (M ∪ F ∪ HR)	5	0
(F ∩ S) \ (HR ∪ M)	12	25
(F ∩ M) \ (S ∪ HR)	6	66.66
(HR ∩ F) \ (M ∪ S)	12	33.33
M \ (S ∪ F ∪ HR)	20	15
F \ (M ∪ S ∪ HR)	10	0
HR \ (M ∪ F ∪ S)	8	50

Some notations used in the above table are defined as:

A \ B implies all those members in A which are not in B.
A ∪ B implies all those members who are in either A or B or both.
A ∩ B implies all those members who are common in both A and B.

Q.40
Find the approximate percentage of girls interested in exactly two streams over the number of students interested in exactly one stream.

1 ○ 21

2 ○ 26

3 ○ 33

4 ○ Cannot be determined

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Directions for questions 39 to 42: Answer the questions on the basis of the information given below.

First year students of MBA from IIM-Z, when asked for their preferences of departments in which they wished to complete their MBA, showed interest among these 4 departments - Sales (S), Marketing (M), Finance (F) and Human Resources (HR). The table shown below provides the information about the number of students showed interest in one or more of these four streams.

Category	Number of Students	Percentage of Girls
(F ∩ HR ∩ S) \ M	6	33.33
(M ∩ HR ∩ S) \ F	8	50
(S ∩ F ∩ M) \ HR	4	50
(HR ∩ M ∩ F) \ S	10	40
(HR ∩ S) \ (M ∪ F)	13	0
(S ∩ M) \ (F ∪ HR)	3	0
(M ∩ F ∩ S ∩ HR)	2	0
(M ∩ HR) \ (S ∪ F)	15	0
S \ (M ∪ F ∪ HR)	5	0
(F ∩ S) \ (HR ∪ M)	12	25
(F ∩ M) \ (S ∪ HR)	6	66.66
(HR ∩ F) \ (M ∪ S)	12	33.33
M \ (S ∪ F ∪ HR)	20	15
F \ (M ∪ S ∪ HR)	10	0
HR \ (M ∪ F ∪ S)	8	50

Some notations used in the above table are defined as:

A \ B implies all those members in A which are not in B.
A ∪ B implies all those members who are in either A or B or both.
A ∩ B implies all those members who are common in both A and B.

Q.41
If the total strength of this batch is 150 students, then how many of them are not interested in any of these four departments?

1 ◯ 14

2 ◯ 15

3 ◯ 16

4 ◯ Cannot be determined

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Answer key/Solution

Directions for questions 39 to 42: Answer the questions on the basis of the information given below.

First year students of MBA from IIM-Z, when asked for their preferences of departments in which they wished to complete their MBA, showed interest among these 4 departments - Sales (S), Marketing (M), Finance (F) and Human Resources (HR). The table shown below provides the information about the number of students showed interest in one or more of these four streams.

Category	Number of Students	Percentage of Girls
(F ∩ HR ∩ S) \ M	6	33.33
(M ∩ HR ∩ S) \ F	8	50
(S ∩ F ∩ M) \ HR	4	50
(HR ∩ M ∩ F) \ S	10	40
(HR ∩ S) \ (M ∪ F)	13	0
(S ∩ M) \ (F ∪ HR)	3	0
(M ∩ F ∩ S ∩ HR)	2	0
(M ∩ HR) \ (S ∪ F)	15	0
S \ (M ∪ F ∪ HR)	5	0
(F ∩ S) \ (HR ∪ M)	12	25
(F ∩ M) \ (S ∪ HR)	6	66.66
(HR ∩ F) \ (M ∪ S)	12	33.33
M \ (S ∪ F ∪ HR)	20	15
F \ (M ∪ S ∪ HR)	10	0
HR \ (M ∪ F ∪ S)	8	50

Some notations used in the above table are defined as:

A \ B implies all those members in A which are not in B.
A ∪ B implies all those members who are in either A or B or both.
A ∩ B implies all those members who are common in both A and B.

Q.42
In which of the following departments, the maximum number of girls showed interest to complete their MBA?

1 ○ Finance

2 ○ Marketing

3 ○ Sales

4 ○ Human Resources

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Directions for questions 43 to 46: Answer the questions on the basis of the information given below.

Nine friends – Jamie, Sansa, Jon, Arya, Rob, Ned, Bran, Robert and Dany – live in a building having 9 floors, numbered from 1 to 9, not necessarily in that order, with ground floor being numbered as 1, floor above it is numbered as 2 and so on. All of them are from different cities among – Delhi, Noida, Gurgoan, Jaipur, Lucknow, Pune, Bangalore, Kolkata and Chennai. Three of them had completed their studies from Delhi University (DU), three from IIT and the remaining three from IIM.

• There are two friends living between the floors on which Sansa and Rob live. Arya and Ned belong to Bangalore and Lucknow respectively.
• Robert, Arya and Sansa completed their studies from same college, while floor numbers on which Sansa and Arya live have maximum factors.
• Floor number of house of Rob, who completed his studies from DU, is a prime number which is a factor of 100.
• Person who is from Pune, completed his studies from IIM and has only one person living below his floor.
• Those, who completed their studies from IIT, live on floors with numbers which are perfect square.
• Number of friends living between the floors on which Ned and Jamie live, is square of the number of friends living between the floors on which Ned and Danny, who belongs to Delhi, live.
• Sansa and Jamie belong to Chennai and Kolkata respectively.

Q.43
For how many friends can we uniquely determine their floor number, college and city?

1 ◯ **4**

2 ◯ **5**

3 ◯ **8**

4 ◯ **6**

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Directions for questions 43 to 46: Answer the questions on the basis of the information given below.

Nine friends – Jamie, Sansa, Jon, Arya, Rob, Ned, Bran, Robert and Dany – live in a building having 9 floors, numbered from 1 to 9, not necessarily in that order, with ground floor being numbered as 1, floor above it is numbered as 2 and so on. All of them are from different cities among – Delhi, Noida, Gurgoan, Jaipur, Lucknow, Pune, Bangalore, Kolkata and Chennai. Three of them had completed their studies from Delhi University (DU), three from IIT and the remaining three from IIM.

• There are two friends living between the floors on which Sansa and Rob live. Arya and Ned belong to Bangalore and Lucknow respectively.
• Robert, Arya and Sansa completed their studies from same college, while floor numbers on which Sansa and Arya live have maximum factors.
• Floor number of house of Rob, who completed his studies from DU, is a prime number which is a factor of 100.
• Person who is from Pune, completed his studies from IIM and has only one person living below his floor.
• Those, who completed their studies from IIT, live on floors with numbers which are perfect square.
• Number of friends living between the floors on which Ned and Jamie live, is square of the number of friends living between the floors on which Ned and Danny, who belongs to Delhi, live.
• Sansa and Jamie belong to Chennai and Kolkata respectively.

Q.44
If Bran is living on the floor immediately below Ned's floor, then how many friends are living between the floors on which Jon and Danny live?
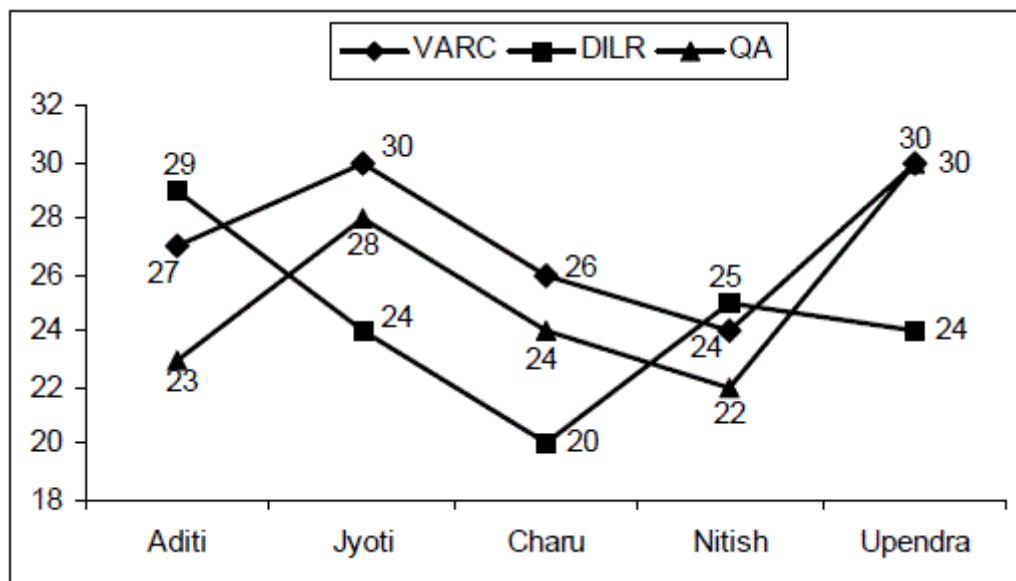
1 ○ 6

2 ○ 5

3 ○ 4

4 ○ 2

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Directions for questions 43 to 46: Answer the questions on the basis of the information given below.

Nine friends – Jamie, Sansa, Jon, Arya, Rob, Ned, Bran, Robert and Dany – live in a building having 9 floors, numbered from 1 to 9, not necessarily in that order, with ground floor being numbered as 1, floor above it is numbered as 2 and so on. All of them are from different cities among – Delhi, Noida, Gurgoan, Jaipur, Lucknow, Pune, Bangalore, Kolkata and Chennai. Three of them had completed their studies from Delhi University (DU), three from IIT and the remaining three from IIM.

• There are two friends living between the floors on which Sansa and Rob live. Arya and Ned belong to Bangalore and Lucknow respectively.
• Robert, Arya and Sansa completed their studies from same college, while floor numbers on which Sansa and Arya live have maximum factors.
• Floor number of house of Rob, who completed his studies from DU, is a prime number which is a factor of 100.
• Person who is from Pune, completed his studies from IIM and has only one person living below his floor.
• Those, who completed their studies from IIT, live on floors with numbers which are perfect square.
• Number of friends living between the floors on which Ned and Jamie live, is square of the number of friends living between the floors on which Ned and Danny, who belongs to Delhi, live.
• Sansa and Jamie belong to Chennai and Kolkata respectively.

Q.45
Robert completed his studies from which college?

1 ○ IIT

2 ○ DU

3 ○ IIM

4 ○ Cannot be determined

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Directions for questions 43 to 46: Answer the questions on the basis of the information given below.

Nine friends – Jamie, Sansa, Jon, Arya, Rob, Ned, Bran, Robert and Dany – live in a building having 9 floors, numbered from 1 to 9, not necessarily in that order, with ground floor being numbered as 1, floor above it is numbered as 2 and so on. All of them are from different cities among – Delhi, Noida, Gurgoan, Jaipur, Lucknow, Pune, Bangalore, Kolkata and Chennai. Three of them had completed their studies from Delhi University (DU), three from IIT and the remaining three from IIM.

• There are two friends living between the floors on which Sansa and Rob live. Arya and Ned belong to Bangalore and Lucknow respectively.
• Robert, Arya and Sansa completed their studies from same college, while floor numbers on which Sansa and Arya live have maximum factors.
• Floor number of house of Rob, who completed his studies from DU, is a prime number which is a factor of 100.
• Person who is from Pune, completed his studies from IIM and has only one person living below his floor.
• Those, who completed their studies from IIT, live on floors with numbers which are perfect square.
• Number of friends living between the floors on which Ned and Jamie live, is square of the number of friends living between the floors on which Ned and Danny, who belongs to Delhi, live.
• Sansa and Jamie belong to Chennai and Kolkata respectively.

Q.46
On which floor does Arya live?

1 ○ **4**

2 ○ **8**

3 ○ **9**
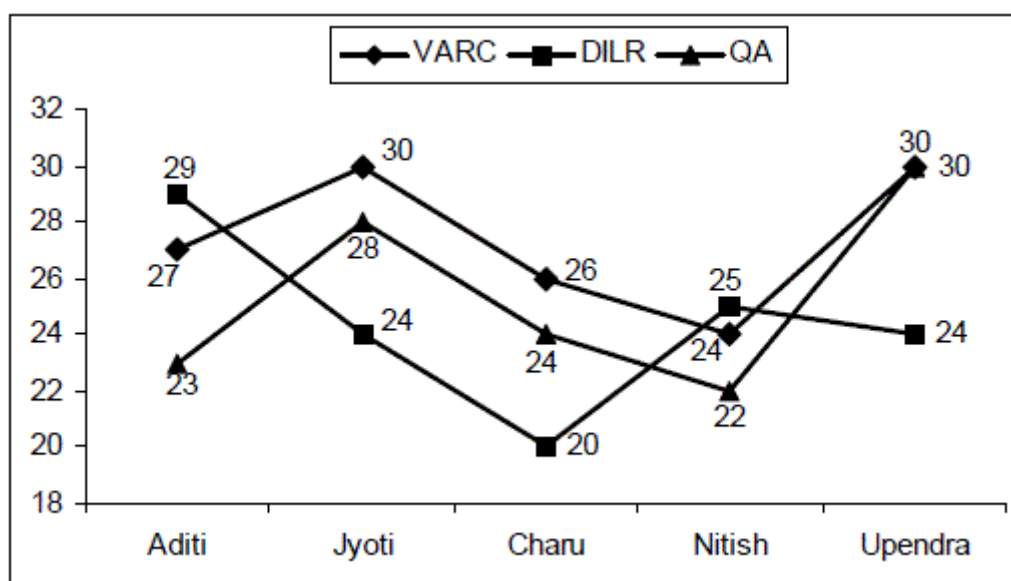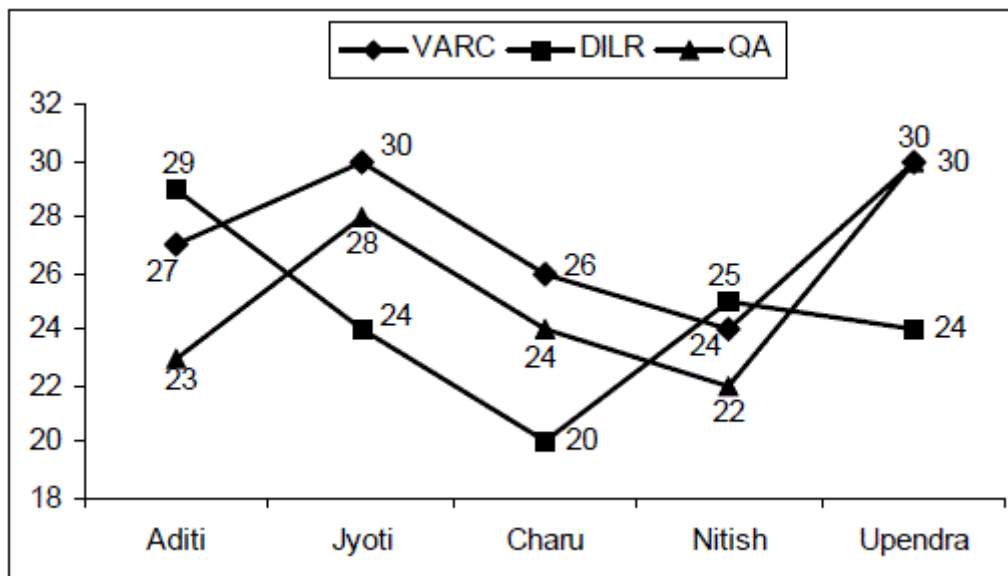
4 ○ **6**

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Directions for questions 47 to 50: Answer the questions on the basis of the information given below.

Common Admission Test (CAT) is an online computer based test which is conducted by Indian Institute of management (IIM), for the candidates seeking admission in MBA or PGDM programs at various IIMs. The test is divided into three sections−Verbal and Reading Comprehensions (VARC), Data Interpretation and Logical Reasoning (DILR) and Quantitative Aptitude (QA). The number of questions in VARC, DILR and QA are 34, 32 and 34 respectively. In each section, 24 questions are multiple choice questions (MCQ), each having four options and remaining questions are non-MCQ. In each section, every question carries 1 mark. There is a penalty (or negative marking) for every answer marked incorrectly in MCQ only while no penalty is there for incorrect answer given of non-MCQ. The table given below provides a brief of the marking scheme for each section for MCQ questions:

Sections	Marks given for every correct answer	Marks deducted for every incorrect answer	Marks deducted for every un-attempted question
VARC	1	$-\dfrac{1}{2}$	0
DILR	1	$-\dfrac{1}{3}$	0
QA	1	$-\dfrac{1}{4}$	0

The line graph given below represents the number of questions attempted by five aspirants − Aditi, Jyoti, Charu, Nitish and Upendra − in each of the three sections. It is also known that the total marks obtained by adding the marks of all the three sections together, for each of the aspirant, is not less than zero.

Q.47
If in each section, the number of questions marked correctly by Aditi is at least 50 percent of the number of questions attempted by her, then what could be her minimum total score (in nearest integer)?

1 ○ **26**

2 ○ **27**

3 ○ **28**

4 ○ **30**
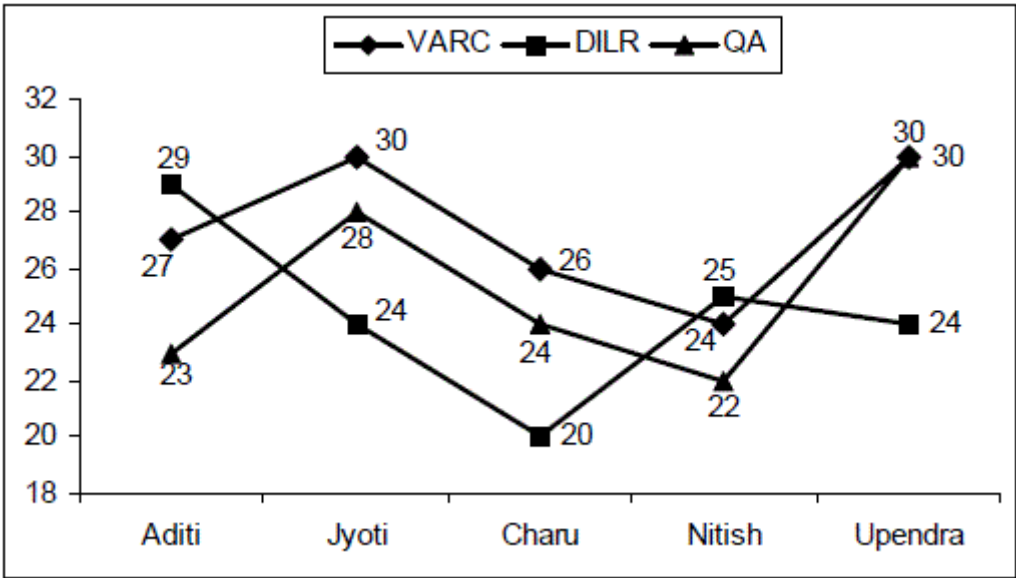
Directions for questions 47 to 50: Answer the questions on the basis of the information given below.

Common Admission Test (CAT) is an online computer based test which is conducted by Indian Institute of management (IIM), for the candidates seeking admission in MBA or PGDM programs at various IIMs. The test is divided into three sections−Verbal and Reading Comprehensions (VARC), Data Interpretation and Logical Reasoning (DILR) and Quantitative Aptitude (QA). The number of questions in VARC, DILR and QA are 34, 32 and 34 respectively. In each section, 24 questions are multiple choice questions (MCQ), each having four options and remaining questions are non-MCQ. In each section, every question carries 1 mark. There is a penalty (or negative marking) for every answer marked incorrectly in MCQ only while no penalty is there for incorrect answer given of non-MCQ. The table given below provides a brief of the marking scheme for each section for MCQ questions:

Sections	Marks given for every correct answer	Marks deducted for every incorrect answer	Marks deducted for every un-attempted question
VARC	1	$-\dfrac{1}{2}$	0
DILR	1	$-\dfrac{1}{3}$	0
QA	1	$-\dfrac{1}{4}$	0

The line graph given below represents the number of questions attempted by five aspirants − Aditi, Jyoti, Charu, Nitish and Upendra − in each of the three sections. It is also known that the total marks obtained by adding the marks of all the three sections together, for each of the aspirant, is not less than zero.

Q.48
Out of the given five aspirants, at most how many aspirants can have equal marks in all the three sections?

1 ○ 1

Directions for questions 47 to 50: Answer the questions on the basis of the information given below.

Common Admission Test (CAT) is an online computer based test which is conducted by Indian Institute of management (IIM), for the candidates seeking admission in MBA or PGDM programs at various IIMs. The test is divided into three sections–Verbal and Reading Comprehensions (VARC), Data Interpretation and Logical Reasoning (DILR) and Quantitative Aptitude (QA). The number of questions in VARC, DILR and QA are 34, 32 and 34 respectively. In each section, 24 questions are multiple choice questions (MCQ), each having four options and remaining questions are non-MCQ. In each section, every question carries 1 mark. There is a penalty (or negative marking) for every answer marked incorrectly in MCQ only while no penalty is there for incorrect answer given of non-MCQ. The table given below provides a brief of the marking scheme for each section for MCQ questions:

Sections	Marks given for every correct answer	Marks deducted for every incorrect answer	Marks deducted for every un-attempted question
VARC	1	$-\dfrac{1}{2}$	0
DILR	1	$-\dfrac{1}{3}$	0
QA	1	$-\dfrac{1}{4}$	0

The line graph given below represents the number of questions attempted by five aspirants – Aditi, Jyoti, Charu, Nitish and Upendra – in each of the three sections. It is also known that the total marks obtained by adding the marks of all the three sections together, for each of the aspirant, is not less than zero.

Q.49

If the total marks (adding marks of all the three sections) obtained by Upendra is 51, then find the maximum number of questions marked incorrectly by him in all the three sections taken together.

Directions for questions 47 to 50: Answer the questions on the basis of the information given below.

Common Admission Test (CAT) is an online computer based test which is conducted by Indian Institute of management (IIM), for the candidates seeking admission in MBA or PGDM programs at various IIMs. The test is divided into three sections–Verbal and Reading Comprehensions (VARC), Data Interpretation and Logical Reasoning (DILR) and Quantitative Aptitude (QA). The number of questions in VARC, DILR and QA are 34, 32 and 34 respectively. In each section, 24 questions are multiple choice questions (MCQ), each having four options and remaining questions are non-MCQ. In each section, every question carries 1 mark. There is a penalty (or negative marking) for every answer marked incorrectly in MCQ only while no penalty is there for incorrect answer given of non-MCQ. The table given below provides a brief of the marking scheme for each section for MCQ questions:

Sections	Marks given for every correct answer	Marks deducted for every incorrect answer	Marks deducted for every un-attempted question
VARC	1	$-\dfrac{1}{2}$	0
DILR	1	$-\dfrac{1}{3}$	0
QA	1	$-\dfrac{1}{4}$	0

The line graph given below represents the number of questions attempted by five aspirants – Aditi, Jyoti, Charu, Nitish and Upendra – in each of the three sections. It is also known that the total marks obtained by adding the marks of all the three sections together, for each of the aspirant, is not less than zero.

Q.50

If the number of questions marked correctly in all the sections taken together by Aditi, Jyoti, Charu, Nitish and Upendra are a, b, c, d and e respectively, then find the minimum value of (a + b + c + d + e).

Directions for questions 51 to 54: Answer the questions on the basis of the information given below.

Coach Bangar has to select a team of 9 players out of 6 batsmen: A, B, C, D, E and F; 5 bowlers: P, Q, R, S and T; and 2 wicketkeepers: X and Y. Further, he needs to keep in mind following certain restrictions:

i) He needs to select at least 3 batsmen, at least 2 bowlers and at least 1 wicket-keeper.
ii) If he selects A, he must select P and must not select X.
iii) If he selects B, he must not select R and must select Y.
iv) If he does not select C, S must be selected and T must not be selected.
v) If he selects both E and F, then he must select R and must not select Y.

Q.51

If A is selected, then which of the following players must be selected?

1 ⚪ E

2 ⚪ C

3 ⚪ D

4 ⚪ B

Q.52

If B is not there, then what is the total number of ways in which he can select the team?

1 ○ **28**

2 ○ **29**

3 ○ **30**

4 ○ **None of these**

Directions for questions 51 to 54: Answer the questions on the basis of the information given below.

Coach Bangar has to select a team of 9 players out of 6 batsmen: A, B, C, D, E and F; 5 bowlers: P, Q, R, S and T; and 2 wicketkeepers: X and Y. Further, he needs to keep in mind following certain restrictions:

i) He needs to select at least 3 batsmen, at least 2 bowlers and at least 1 wicket-keeper.
ii) If he selects A, he must select P and must not select X.
iii) If he selects B, he must not select R and must select Y.
iv) If he does not select C, S must be selected and T must not be selected.
v) If he selects both E and F, then he must select R and must not select Y.

Q.53
Which of the following pair of friends can be selected together?

1 ○ **C and T**

2 ○ **C and S**

3 ○ **E and Y**

4 ○ **All of the above**

Directions for questions 51 to 54: Answer the questions on the basis of the information given below.

Coach Bangar has to select a team of 9 players out of 6 batsmen: A, B, C, D, E and F; 5 bowlers: P, Q, R, S and T; and 2 wicketkeepers: X and Y. Further, he needs to keep in mind following certain restrictions:

i) He needs to select at least 3 batsmen, at least 2 bowlers and at least 1 wicket-keeper.
ii) If he selects A, he must select P and must not select X.
iii) If he selects B, he must not select R and must select Y.
iv) If he does not select C, S must be selected and T must not be selected.
v) If he selects both E and F, then he must select R and must not select Y.

Q.54
How many players must be selected in every combination of team?

1 ⚪ **2**

2 ⚪ **1**

3 ⚪ **0**

4 ⚪ **3**

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Directions for questions 55 to 58: Answer the questions on the basis of the information given below.

Six friends - Praneet (P), Quershi (Q), Ravi (R), Sandeep (S), Tina (T) and Umil (U) - went to Apple city from India and exchanged their currencies at Apple city airport. The denomination of currency asked by all friends – P, Q, R, S, T and U - were $2, $3, $7, $11, $13 and $17 respectively. Each friend exchanged his respective currency in one denomination only and could have spent it in any denomination based on the change he/she received from a shopkeeper during his shopping. The amount spent by them in the Apple city were $238, $171, $98, $429, $296 and $363 not necessarily in that order. While returning to India, they exchanged their remaining money in Indian currency and received the amount of Rs. 360, Rs.420, Rs.600, Rs.720, Rs.840 and Rs.540. Further, the dollar exchange rate was fixed to Rs. 60 per dollar.

Q.55
What was the amount spent by Sandeep?

1 ⚪ $429

2 ⚪ $286

3 ⚪ $363

4 ⚪ $98

Directions for questions 55 to 58: Answer the questions on the basis of the information given below.

Six friends - Praneet (P), Quershi (Q), Ravi (R), Sandeep (S), Tina (T) and Umil (U) - went to Apple city from India and exchanged their currencies at Apple city airport. The denomination of currency asked by all friends – P, Q, R, S, T and U - were $2, $3, $7, $11, $13 and $17 respectively. Each friend exchanged his respective currency in one denomination only and could have spent it in any denomination based on the change he/she received from a shopkeeper during his shopping. The amount spent by them in the Apple city were $238, $171, $98, $429, $296 and $363 not necessarily in that order. While returning to India, they exchanged their remaining money in Indian currency and received the amount of Rs. 360, Rs.420, Rs.600, Rs.720, Rs.840 and Rs.540. Further, the dollar exchange rate was fixed to Rs. 60 per dollar.

Q.56
For how many friends can the amount spent by them be determined uniquely?

1 ○ Less than 4

2 ○ 4

3 ○ 5

4 ○ 6

Q.57
What is the difference between the amount spent by Ravi and Tina?

1 ○ $258

2 ○ $67

3 ○ $125

4 ○ $191

Directions for questions 55 to 58: Answer the questions on the basis of the information given below.

Six friends - Praneet (P), Quershi (Q), Ravi (R), Sandeep (S), Tina (T) and Umil (U) - went to Apple city from India and exchanged their currencies at Apple city airport. The denomination of currency asked by all friends – P, Q, R, S, T and U - were $2, $3, $7, $11, $13 and $17 respectively. Each friend exchanged his respective currency in one denomination only and could have spent it in any denomination based on the change he/she received from a shopkeeper during his shopping. The amount spent by them in the Apple city were $238, $171, $98, $429, $296 and $363 not necessarily in that order. While returning to India, they exchanged their remaining money in Indian currency and received the amount of Rs. 360, Rs.420, Rs.600, Rs.720, Rs.840 and Rs.540. Further, the dollar exchange rate was fixed to Rs. 60 per dollar.

Q.58
The total converted money received by Tina on Apple city airport was

1 ○ $377

2 ○ $306

3 ○ $438

4 ○ $177

Directions for questions 59 to 62: Answer the questions on the basis of the information given below.

A leading newspaper 'TOI' has gathered the data of its number of readers in four consecutive months of 2018 i.e., July, August, September and October. Some of the readers continues with 'TOI' for more than one month too but everyone reads it in at least one month. Also, no reader who read 'TOI' in October, read it in any other month. Further it is known that:

(1) The number of readers who read 'TOI' in exactly 2 consecutive months is $1/5^{th}$ of the number of readers who read it in exactly 1 month.
(2) The number of readers who read it in at least 2 consecutive months is 50.
(3) The number of readers who read it in July but not in August is 20.
(4) The sum of the number of readers who read it in July only and August only is equal to the sum of the number of readers who read it in September only and October.
(5) 42 readers read it in July.
(6) The number of readers who read it in only October is twice of those who read it in only July which in turn is not less than half of those who read it in only September.
(7) 140 people read it in exactly 1 month.

Q.59
What is the minimum possible number of readers who read it in only August?

1 ○ **48**

2 ○ **52**

3 ○ **53**

4 ○ **50**

Q.60
Maximum how many readers read 'TOI' in exactly 2 months but not consecutive months?

Directions for questions 59 to 62: Answer the questions on the basis of the information given below.

A leading newspaper 'TOI' has gathered the data of its number of readers in four consecutive months of 2018 i.e., July, August, September and October. Some of the readers continues with 'TOI' for more than one month too but everyone reads it in at least one month. Also, no reader who read 'TOI' in October, read it in any other month. Further it is known that:

(1) The number of readers who read 'TOI' in exactly 2 consecutive months is $1/5^{th}$ of the number of readers who read it in exactly 1 month.
(2) The number of readers who read it in at least 2 consecutive months is 50.
(3) The number of readers who read it in July but not in August is 20.
(4) The sum of the number of readers who read it in July only and August only is equal to the sum of the number of readers who read it in September only and October.
(5) 42 readers read it in July.
(6) The number of readers who read it in only October is twice of those who read it in only July which in turn is not less than half of those who read it in only September.
(7) 140 people read it in exactly 1 month.

Q.61
How many readers read it in all the 3 months- July, August and September?

Directions for questions 59 to 62: Answer the questions on the basis of the information given below.

A leading newspaper 'TOI' has gathered the data of its number of readers in four consecutive months of 2018 i.e., July, August, September and October. Some of the readers continues with 'TOI' for more than one month too but everyone reads it in at least one month. Also, no reader who read 'TOI' in October, read it in any other month. Further it is known that:

(1) The number of readers who read 'TOI' in exactly 2 consecutive months is $1/5^{th}$ of the number of readers who read it in exactly 1 month.
(2) The number of readers who read it in at least 2 consecutive months is 50.
(3) The number of readers who read it in July but not in August is 20.
(4) The sum of the number of readers who read it in July only and August only is equal to the sum of the number of readers who read it in September only and October.
(5) 42 readers read it in July.
(6) The number of readers who read it in only October is twice of those who read it in only July which in turn is not less than half of those who read it in only September.
(7) 140 people read it in exactly 1 month.

Q.62
What is the minimum difference between the number of people who read it in October and those who read it in September only?

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🔑 Answer key/Solution

Directions for questions 63 to 66: Answer the questions on the basis of the information given below.

Saral appeared for a CAT mock test, having three sections - QA, LRDI and VA. After completing the test, his score card shows four scores i.e. the scores in the three sections mentioned above and the total score which is the sum of the scores of these 3 sections.
Saral, being a curious mind, wrote each of his scores as the percentage of the other scores, as shown in the table given below using some variables. For example, in the table given below 'a' represents that his score in QA is a% of his score in VA and 'b' represents that his score in VA is b% of his score in LRDI.

as % of / Score in	QA	LRDI	VA	Total
QA	–	75%	a	f
LRDI	c	–	g	h
VA	j	b	–	$26\frac{6}{19}\%$
Total	d	e	k	–

Q.63
How many variables, given in the table, are greater than 100?

Directions for questions 63 to 66: Answer the questions on the basis of the information given below.

Saral appeared for a CAT mock test, having three sections - QA, LRDI and VA. After completing the test, his score card shows four scores i.e. the scores in the three sections mentioned above and the total score which is the sum of the scores of these 3 sections.

Saral, being a curious mind, wrote each of his scores as the percentage of the other scores, as shown in the table given below using some variables. For example, in the table given below 'a' represents that his score in QA is a% of his score in VA and 'b' represents that his score in VA is b% of his score in LRDI.

as % of / Score in	QA	LRDI	VA	Total
QA	–	75%	a	f
LRDI	c	–	g	h
VA	j	b	–	$26\frac{6}{19}\%$
Total	d	e	k	–

Q.64

What is the percentage point difference between a and b?

1 ○ **12.5**

2 ○ **57.5**

3 ○ **79.16**

4 ○ **104.17**

Directions for questions 63 to 66: Answer the questions on the basis of the information given below.

Saral appeared for a CAT mock test, having three sections - QA, LRDI and VA. After completing the test, his score card shows four scores i.e. the scores in the three sections mentioned above and the total score which is the sum of the scores of these 3 sections.

Saral, being a curious mind, wrote each of his scores as the percentage of the other scores, as shown in the table given below using some variables. For example, in the table given below 'a' represents that his score in QA is a% of his score in VA and 'b' represents that his score in VA is b% of his score in LRDI.

as % of / Score in	QA	LRDI	VA	Total
QA	–	75%	a	f
LRDI	c	–	g	h
VA	j	b	–	$26\frac{6}{19}\%$
Total	d	e	k	–

Q.65
The number of variables, in the table, having non-integral value is

1 ○ 7

2 ○ 8

3 ○ 9

4 ○ 6

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🔑 Answer key/Solution

Directions for questions 63 to 66: Answer the questions on the basis of the information given below.

Saral appeared for a CAT mock test, having three sections - QA, LRDI and VA. After completing the test, his score card shows four scores i.e. the scores in the three sections mentioned above and the total score which is the sum of the scores of these 3 sections.

Saral, being a curious mind, wrote each of his scores as the percentage of the other scores, as shown in the table given below using some variables. For example, in the table given below 'a' represents that his score in QA is a% of his score in VA and 'b' represents that his score in VA is b% of his score in LRDI.

as % of / Score in	QA	LRDI	VA	Total
QA	–	75%	a	f
LRDI	c	–	g	h
VA	j	b	–	$26\frac{6}{19}\%$
Total	d	e	k	–

Q.66
Which variable, in the table, has the largest value?

1 ○ d

2 ○ e

3 ○ k

4 ○ g

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Answer key/Solution

Sec 3

Q.67
What is the remainder when 483483... upto 300 digits is divided by 101?

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Answer key/Solution

Q.68
One day, a boy started to paint a fence. On the next day, two more boys joined him. Again on the next day, three more boys joined them and so on. Following this way the fence got painted completely in exactly 20 days. If a man can paint twice as fast as a boy, then find the number of days required by 10 men working together to paint that fence completely.

Q.69
Bithika takes 45 strides, each 2 feet long, per minute during morning walk. However, while walking to school, she travels at 50% higher speed, taking strides, each of which are 2.5 feet long. How many more strides does she take per minute while walking to the school as compared to those she take during her morning walk?

1 ○ 9

2 ○ 18

3 ○ 36

4 ○ 45

Q.70

By selling an article at a discount of 25%, a shopkeeper gets Rs.16 less as profit than by selling it at $16\frac{2}{3}\%$ discount. If the cost price of 12 articles is equal to the marked price of 8 articles, then find the cost price (in rupees) of each article.
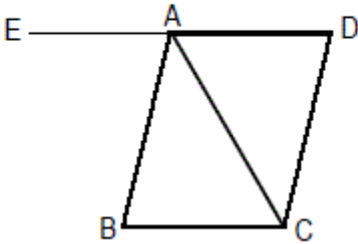
Q.71

If AB = AC = AD, ∠BAE = 72° and ∠ABC = 2∠ADC in the figure shown below, then find ∠ACD (in degrees).

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🔑 Answer key/Solution

Q.72

Three positive numbers form an increasing G.P. If the middle term in this G.P is tripled, the new numbers are in A.P. Then the common ratio of the G.P. is

1 ○ $3 - 2\sqrt{2}$

2 ○ $3 + 2\sqrt{2}$

3 ○ $3 + 3\sqrt{2}$

4 ○ $2 - \sqrt{2}$

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🔑 Answer key/Solution

Q.73

Joshua took a loan of Rs.67,100 from a moneylender at 20% per annum under compound interest, compounded annually, and agreed to repay it in four equal annual installments, installment being paid at the end of each year. Find the value (in Rs.) of each installment.

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🔑 Answer key/Solution

Q.74

Sanjay left his house between 2 p.m. and 3 p.m. when the two hands were at 50°. He came back between 9 p.m. and 10 p.m. on the same day and the angle between the hands when he came back was still 50°. What is the minimum time (in minutes) for which he was out?

1 ○ $476\dfrac{4}{11}$

2 ○ $458\dfrac{2}{11}$

3 ○ **440**

4 ○ **None of these**

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🔑 Answer key/Solution

Q.75

Out of 50 persons in a club, everyone plays at least one of the three games that are available and the number of people who play exactly one of the three games is more than the number of people who play more than one of the three games. Everyone who plays football elects to play badminton as well. Nobody plays both football and hockey together whereas 13 play both badminton and hockey. If the number of persons who play only hockey is minimum, then which of the following options cannot be the number of persons who play only badminton?

1 ○ **26**

2 ○ **28**

3 ○ **24**

4 ○ **30**

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🔑 Answer key/Solution

Q.76

In a class, each student opted for either dancing or singing or both for their extracurricular activity. 60% of the girls and 50% of the boys opted for dancing, whereas 50% of the girls and 55% of the boys opted for singing. The number of students who opted for dancing was six more than those who opted for singing. The number of girls who opted for singing was more than the number of boys who opted for singing. If the difference between the number of boys and number of girls who opted for singing and the difference between the number of boys and number of girls who opted for dancing were in the ratio 9 : 14, then what is the total number of students in the class?

Q.77

If 'a' ounces each of salt and water are added to 'n' ounces of an n% salt solution (by weight) to obtain an (n − 20)% salt solution, then 'a' is equal to

1 ○ $\dfrac{5n}{n-30}$

2 ○ $\dfrac{20n}{n-50}$

3 ○ $\dfrac{10n}{n-70}$

4 ○ $\dfrac{15n}{n-60}$

Q.78

Find the sum of the first n terms of the series:

$$\log x^2 + \log\frac{x^4}{y^3} + \log\frac{x^6}{y^6} + \log\frac{x^8}{y^9} + \dots$$

1 ○ $\log\left(\dfrac{x^{n+1}}{y^{3\left(\frac{n-1}{2}\right)}}\right)^n$

2 ○ $\log\left(\dfrac{x^{n+1}}{y^{3\left(\frac{n+1}{2}\right)}}\right)^n$

3 ○ $\log\left(\dfrac{x^{n+1}}{y^{3\left(\frac{n}{2}\right)}}\right)^n$

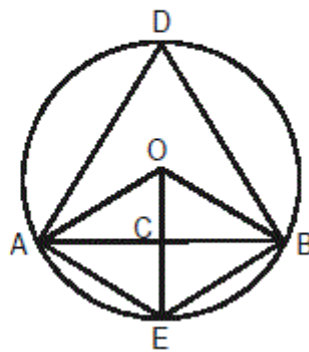4 ○ $\log\left(\dfrac{x^{n+1}}{y^{\left(\frac{n-1}{2}\right)}}\right)^{n}$

Q.79

In the figure given below, O is the center of the circle, $\angle OBE = 50°$ and C is the midpoint of the chord AB. Find the measure (in degrees) of $\angle ADB$.

Q.80

If p and q are positive integers and $\left(\dfrac{1}{p} + \dfrac{5}{q}\right) = \dfrac{1}{15}$, then how many values of q, less than 100, satisfy the above equation?

Q.81

If $f(x) = |x + 1| + 2|x + 2| + 3|x + 3|$, then find the least possible value of f(x).

1 ○ $3\frac{2}{3}$

2 ○ **4**

3 ○ $5\frac{2}{3}$

4 ○ $3\frac{1}{3}$

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⚷ Answer key/Solution

Q.82

A boat started from a point in a river and travelled a certain distance upstream, after which it turned back and returned to its starting point. If the boat covered the round trip journey in two hours and the speed of the boat upstream was 25% of that of downstream, then how much more time (in minutes) did the boat take to travel upstream than what it took to travel downstream?

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⚷ Answer key/Solution

Q.83

A rectangle of the largest possible area is cut out from a semicircle of perimeter 72 cm. What is the area (in sq. cm) of that rectangle? (Take π = 22/7)

1 ○ **196**

2 ○ **225**

3 ○ **256**

4 ○ **441**

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⚷ Answer key/Solution

Q.84

There are five positive integers. When any four of these integers are considered, and their average is added to the fifth integer, we get the following numbers: 41, 44, 50, 56 and 65. Which of the following gives the value of one of these five integers?

1 ○ 28

2 ○ 44

3 ○ 36

4 ○ 18

Q.85

In a country, state A has u% of the country's population and x% of its wealth, while state B has y% of the country's population and z% of its wealth. If the total wealth, for both the states, is shared equally by all the citizens residing in that state, find the ratio of the wealth of a citizen of state A to that of a citizen of state B.

1 ○ x/z : u/y

2 ○ u/z : x/y

3 ○ x/y : u/z

4 ○ None of these

Q.86

If for some real values of x_i, it is known that

$$\sqrt{x_1-1}+2\sqrt{x_2-4}+3\sqrt{x_3-9}+...+n\sqrt{x_n-n^2}=\frac{1}{2}(x_1+x_2+x_3+...+x_n),$$

then calculate the number of trailing zeroes in $\prod_{i=1}^{50} x_i$.

[Note: $\prod_{i=1}^{n} x_i$ means the product of all the numbers $x_1, x_2, x_3, ..., x_n$]

1 ○ **12**

2 ○ **24**

3 ○ **25**

4 ○ **50**

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🔑 Answer key/Solution

Q.87
If PQRSTU is a regular hexagon, then find the ratio of the area of triangle PRT to the area of the given hexagon.

1 ○ **1 : 2**

2 ○ **1 : 4**

3 ○ **3 : 10**

4 ○ **2 : 5**

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🔑 Answer key/Solution

Q.88
Ajit marks up an article by t% (t > 0), then gives a discount of t/4% and still gets a profit of t/4%. If he marks up the article by t/2% and gives a discount of t/6%, then what would be his profit percentage?

1 ○ **25%**

2 ○ **33.33%**

3 ○ **40%**

4 ○ **50%**

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🔑 Answer key/Solution

Q.89

If A starts a work, completes one-third of it and hands it over to B to complete the remaining work, it would take 40 days for the work to be completed. Instead, if B first completes one-third of the work and then A takes over and completes the remaining work, it would take 35 days for the work to be completed. In how many days can A and B together complete the entire work?

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Answer key/Solution

Q.90

How many non-positive integral solutions are there for the equation:

$$\left|\frac{a+1}{a}\right| + |a+1| = \frac{(a+1)^2}{|a|}?$$

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Answer key/Solution

Q.91

PQRS is a trapezium, where PQ and RS are non-parallel sides with PS = 6 cm and QR = 9 cm. Two parallel line segments MN and OT are drawn from PQ to SR such that the lines PQ and SR get trisected. What is the ratio of the lengths of those drawn line segments? (Note: Line MN is drawn above the line OT)

1 ○ 7 : 8

2 ○ 5 : 6

3 ○ 3 : 4

4 ○ 10 : 11

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Answer key/Solution

Q.92

A number is called 'Fiver' if the digital sum of the number is 5 i.e. the sum of the digits until we get a single digit number. For example, 23, 59, 176 etc. are Fivers. How many 3-digit 'Fivers' are there?

Q.93

A shopkeeper mixes three varieties - A, B and C - of wheat costing Rs.16/kg, Rs.18/kg and Rs.24/ kg and sells the mixture at a profit of 20% at Rs.24/kg. Find the ratio of the quantity of variety B and the difference between the quantities of varieties C and A.

1 ○ 1 : 5

2 ○ 3 : 1

3 ○ 1 : 2

4 ○ 2 : 1

Q.94

If $f(a) = \log\left(\dfrac{2-a}{2+a}\right)$, then which of the following is equivalent to f(a) + f(b)?

1 ○ f(a + b)

2 ○ $4(a + b)f\left(\dfrac{1}{4+ab}\right)$

3 ○ $\dfrac{f(a)+f(b)}{4+ab}$

4 ○ $f\left(\dfrac{4(a+b)}{4+ab}\right)$

Q.95

Mona has five pairs of shoes of different colors, including a pink colour. On no two consecutive days of the week, from Monday to Saturday, she wears the same pair of shoes. If she does not wear the pink pair on Wednesday, then in how many ways can she wear her shoes in a week?

1 ○ **256**

2 ○ **512**

3 ○ **1024**

4 ○ **4096**

Q.96

A circle is tangent to the y-axis at point (0, 2) and one of its x-intercepts is at (8, 0) as shown in the figure. The radius of the circle is

1 ○ **9/2**
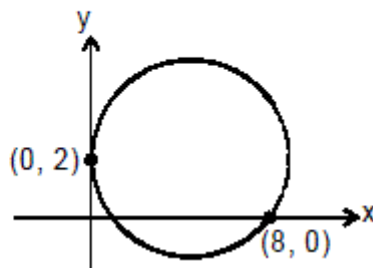
2 ○ **17/2**

3 ○ **17/4**

4 ○ **15/4**

Q.97

Ajay started a business with an investment of Rs. 48,000. After t months, Bimal joined him with an investment of Rs. 48,000, and t months after Bimal, Chanchal joined them with an investment of Rs. 24,000. If at the end of the year, the profit share of Ajay was equal to the sum of the profit shares of Bimal and Chanchal, then find the value of t.

1 ◯ **2**

2 ◯ **3**

3 ◯ **5**

4 ◯ **6**

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🔍 Answer key/Solution

Q.98

If x, y and z are distinct real numbers and u = $x^2 + 4y^2 + 9z^2 - 6yz - 3zx - 2xy$, then u is always

1 ◯ **Positive**

2 ◯ **Non-negative**

3 ◯ **Non-zero**

4 ◯ **Non-positive**

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🔍 Answer key/Solution

Q.99

A bag contains exactly seven candies, five pink and two green. Candies are randomly removed, one at a time without replacement, from the bag until all the pink candies are drawn or all the green candies are drawn. What is the probability that the last candy drawn is green?

1 ◯ **15/22**

2 ◯ **2/3**

3 ◯ **5/7**

4 ◯ **10/21**

Q.100

AB is the diameter of a circle with center O and C is a point on the circle different from A and B. D is a point on BC such that OD⊥BC. E is a point on BD, such that OE bisects ∠BOD and BE : ED = 2 : 1. If F is the midpoint of DC and AB = 24 cm, then find the length (in cm) of AF.

1 ○ $\sqrt{151}$

2 ○ $\sqrt{161}$

3 ○ $\sqrt{171}$

4 ○ $\sqrt{181}$