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INSTRUCTIONS**Before the test:**

1. DO NOT REMOVE THE SEALS OF THE PLASTIC ENVELOPE OF THIS BOOKLET UNTIL THE SIGNAL TO START IS GIVEN.
2. Keep only t Admit Card, pencil, eraser and sharpener with you. DO NOT KEEP with you books, rulers, slide rulers, drawing instruments, calculators (including watch calculators), pagers, cellular phones, stop watches or any other device or loose paper. These should be left at a place indicated by the invigilator.
3. Use only HB pencil to fill in the Answer sheet.
4. Enter in your Answer Sheet: (a) in Box 3, t Test Form Number that appears at the bottom of this page, (b) in Box 4, the Test Booklet Serial Number that appears at the top of this page.
5. Ensure that your personal data have been entered correctly on Side – II of the Answer sheet.
6. Ensure that you have entered your 7-digit Test Registration Number in Box 2 of the Answer sheet correctly.

At the start of the Test:

1. As soon as the signal to start is given, open the Test Booklet.
2. This Test Booklet contains 36 pages, including the blank ones. Immediately after opening the Test Booklet, verify that all the pages are printed properly and are in order. If there is a problem with your Test Booklet, immediately inform the invigilator. You will be provided with a replacement.

How to answer:

1. This test contains **165** questions in three sections. **There are 55 questions in Section I, 55 questions in Section II and 55 questions in Section III.** You have two hours to complete the test. In distributing the time over the three sections, please bear in mind that you need to demonstrate your competence in all three sections.
2. Directions for answering the questions are given before each group of questions. Read these directions carefully and answer the questions by darkening the appropriate circles on the Answer Sheet. Each question has only one correct answer.
3. **Each question carries 1 mark. Each wrong answer will attract a penalty of one-third of the marks allotted to that question.**
4. Do your rough work only on the Test Booklet and Not on the Answer Sheet.
5. Follow the instructions of the invigilator. Candidates found violating the instructions will be disqualified.

After the Test:

1. At the end of the test, remain seated. The invigilator will collect the Answer Sheet from your seat. Do not leave the hall until the invigilator announces “You may leave now”. The invigilator will make the announcement only after collecting the Answer Sheets from all the candidates in the room.
2. You may retain this Test Booklet with you.

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SECTION I

Number of Questions: 55

DIRECTIONS: Each of the five passages given below is followed by questions. Choose the best answer of each question.

PASSAGE I

The current debate on intellectual property rights (IPRs) raises a number of important issues concerning the strategy and policies for building a more dynamic national agricultural research system, the relative roles of public and private sectors, and the role of agribusiness multinational corporations (MNCs). This debate has been stimulated by the international agreement on Trade Related Intellectual Property Rights (TRIPs), negotiated as part of the Uruguay Round. TRIPs, for the first time, seeks to bring innovations in agricultural technology under a new worldwide IPR regime. The agribusiness MNCs (along with pharmaceutical companies) played a leading part in lobbying for such a regime during the Uruguay Round negotiations. The argument was that incentives are necessary to stimulate innovations, and that this calls for a system of patents which gives innovators the sole right to use (or sell/lease the right to use) their innovations for a specified period and protects them against unauthorised copying or use. With strong support of their national governments, they were influential in shaping the agreement on TRIPs, which eventually emerged from the Uruguay Round.

The current debate on TRIPs in India—as indeed elsewhere—echoes wider concerns about ‘privatisation’ of research and allowing a free field for MNCs in the sphere of biotechnology and agriculture. The agribusiness corporations, and those with unbounded faith in the power of science to overcome all likely problems, point to the vast potential that new technology holds for solving the problems of hunger, malnutrition and poverty in the world. The exploitation of this potential should be encouraged and this is best done by the private sector for which patents are essential. Some, who do not necessarily accept this optimism, argue that fears of MNC domination are exaggerated and that farmers will accept their products only if they decisively outperform the available alternatives. Those who argue against agreeing to introduce an IPR regime in agriculture and encouraging private sector research are apprehensive that this will work to the disadvantage of farmers by making them more and more dependent on monopolistic MNCs. A different, though related apprehension is that extensive use of hybrids and genetically engineered new varieties might increase the vulnerability of agriculture to outbreaks of pests and diseases. The larger, longer-term consequences of reduced biodiversity that may follow from the use of specially bred varieties are also another cause for concern. Moreover, corporations, driven by the profit motive, will necessarily tend to underplay, if not ignore, potential adverse consequences, especially those which are unknown and which may manifest themselves only over a relatively long period. On the other hand, high-pressure advertising and aggressive sales campaigns by private companies can seduce farmers into accepting varieties without being aware of potential adverse effects and the possibility of disastrous consequences for their livelihood if these varieties happen to fail. There is no provision under the laws, as they now exist, for compensating users against such eventualities.

Excessive preoccupation with seeds and seed material has obscured other important issues involved in reviewing the research policy. We need to remind ourselves that improved varieties by themselves are not sufficient for sustained growth of yields. In our own experience, some of the early high yielding varieties (HYVs) of rice and wheat were found susceptible to widespread pest attacks; and some had problems of grain

quality. Further research was necessary to solve these problems. This largely successful research was almost entirely done in public research institutions. Of course, it could in principle have been done by private companies, but whether they choose to do so depends crucially on the extent of the loss in market for their original introductions on account of the above factors and whether the companies are financially strong enough to absorb the 'losses', invest in research to correct the deficiencies and recover the lost market. Public research, which is not driven by profit, is better placed to take corrective action. Research for improving common pool resource management, maintaining ecological health and ensuring sustainability is both critical and also demanding in terms of technological challenge and resource requirements. As such research is crucial to the impact of new varieties, chemicals and equipment in the farmer's field, private companies should be interested in such research. But their primary interest is in the sale of seed material, chemicals, equipment and other inputs produced by them. Knowledge and techniques for resource management are not 'marketable' in the same way as those inputs. Their application to land, water and forests has a long gestation and their efficacy depends on resolving difficult problems such as designing institutions for proper and equitable management of common pool resources. Public or quasi-public research institutions informed by broader, long-term concerns can only do such work.

The public sector must therefore continue to play a major role in the national research system. It is both wrong and misleading to pose the problem in terms of public sector versus private sector or of privatisation of research. We need to address problems likely to arise on account of the public-private sector complementarity, and ensure that the public research system performs efficiently. Complementarity between various elements of research raises several issues in implementing an IPR regime. Private companies do not produce new varieties and inputs entirely as a result of their own research. Almost all technological improvement is based on knowledge and experience accumulated from the past, and the results of basic and applied research in public and quasi-public institutions (universities, research organisations). Moreover, as is increasingly recognised, accumulated stock of knowledge does not reside only in the scientific community and its academic publications, but is also widely diffused in traditions and folk knowledge of local communities all over.

The deciphering of the structure and functioning of DNA forms the basis of much of modern biotechnology. But this fundamental breakthrough is a 'public good' freely accessible in the public domain and usable free of any charge. Varieties/techniques developed using that knowledge can however be, and are, patented for private profit. Similarly, private corporations draw extensively, and without any charge, on germ plasm available in varieties of plants species (neem and turmeric are by now famous examples). Publicly funded gene banks as well as new varieties bred by public sector research stations can also be used freely by private enterprises for developing their own varieties and seek patent protection for them. Should private breeders be allowed free use of basic scientific discoveries? Should the repositories of traditional knowledge and germ plasm be collected which are maintained and improved by publicly funded institutions? Or should users be made to pay for such use? If they are to pay, what should be the basis of compensation? Should the compensation be for individuals or for communities/institutions to which they belong? Should individuals/ institutions be given the right of patenting their innovations? These are some of the important issues that deserve more attention than they now get and need serious detailed study to evolve reasonably satisfactory, fair and workable solutions. Finally, the tendency to equate the public sector with the government is wrong. The public space is much wider than government departments and includes co-operatives, universities, public trust and a variety of non-governmental organisations (NGOs). Giving greater autonomy to research organisations from government control and giving non-government public institutions the space and resources to play a larger, more effective role in research, is therefore an issue of direct relevance in restructuring the public research system.

1. *Which one of the following statements describes an important issue, or important issues, not being raised in the context of the current debate on IPRs?*
 - (1) The role of MNCs in the sphere of biotechnology and agriculture.
 - (2) The strategy and policies for establishing an IPR regime for Indian agriculture.
 - (3) The relative roles of public and private sectors.
 - (4) Wider concerns about 'privatisation' of research.

2. *The fundamental breakthrough in deciphering the structure and functioning of DNA has become a public good. This means that*
 - (1) breakthroughs in fundamental research on DNA are accessible by all without any monetary considerations.
 - (2) the fundamental research on DNA has the characteristic of having beneficial effects for the public at large.
 - (3) due to the large scale of fundamental research on DNA, it falls in the domain of public sector research institutions.
 - (4) the public and other companies must have free access to such fundamental breakthroughs in research.

3. *In debating the respective roles of the public and private sectors in the national research system, it is important to recognise*
 - (1) that private companies do not produce new varieties and inputs entirely on their own research.
 - (2) that almost all technological improvements are based on knowledge and experience accumulated from the past.
 - (3) the complementary role of public-and private-sector research.
 - (4) that knowledge repositories are primarily the scientific community and its academic publications.

4. *Which one of the following may provide incentives to address the problem of potential adverse consequences of biotechnology?*
 - (1) Include IPR issues in the TRIPs agreement.
 - (2) Nationalise MNCs engaged in private research in biotechnology.
 - (3) Encourage domestic firms to patent their innovations.
 - (4) Make provisions in the law for user compensation against failure of newly developed varieties.

5. *Which of the following statements is not a likely consequence of emerging technologies in agriculture?*
 - (1) Development of newer and newer varieties will lead to increase in biodiversity.
 - (2) MNCs may underplay the negative consequences of the newer technology on environment.
 - (3) Newer varieties of seeds may increase vulnerability of crops to pests and diseases.
 - (4) Reforms in patent laws and user compensation against crop failures would be needed to address new technology problems.

6. *The TRIPs agreement emerged from the Uruguay Round to*

- (1) address the problem of adverse consequences of genetically engineered new varieties of grain.
- (2) fulfil the WTO requirement to have an agreement on trade related property rights.
- (3) provide incentives to innovators by way of protecting their intellectual property.
- (4) give credibility to the innovations made by MNCs in the field of pharmaceuticals and agriculture.

7. *Public or quasi-public research institutions are more likely than private companies to address the negative consequences of new technologies, because of which of the following reasons?*

- (1) Public research is not driven by profit motive.
- (2) Private companies may not be able to absorb losses arising out of the negative effects of the new technologies.
- (3) Unlike new technology products, knowledge and techniques for resource management are not amenable to simple market transactions.
- (4) All of the above.

8. *While developing a strategy and policies for building a more dynamic national agricultural research system, which one of the following statements needs to be considered?*

- (1) Public and quasi-public institutions are not interested in making profits.
- (2) Public and quasi-public institutions have a broader and long-term outlook than private companies.
- (3) Private companies are incapable of building products based on traditional and folk knowledge.
- (4) Traditional and folk knowledge cannot be protected by patents.

PASSAGE II

One of the criteria by which we judge the vitality of a style of painting is its ability to renew itself-its responsiveness to the changing nature and quality of experience, the degree of conceptual and formal innovation that it exhibits. By this criterion, it would appear that the practice of abstractionism has failed to engage creatively with the radical change in human experience in recent decades. It has, seemingly, been unwilling to re-invent itself in relation to the systems of artistic expression and viewers' expectations that have developed under the impact of the mass media.

The judgment that abstractionism has slipped into 'inertia gear' is gaining endorsement, not only among discerning viewers and practitioners of other art forms, but also among abstract painters themselves. Like their companions elsewhere in the world, abstractionists in India are asking themselves an overwhelming question today: Does abstractionism have a future? The major crisis that abstractionist face is that of revitalising their picture surface; few have improvised any solutions beyond the ones that were exhausted by the 1970s. Like all revolutions, whether in politics or in art, abstractionism must now confront its moment of truth: having begun life as a new and radical pictorial approach to experience, it has become an entrenched orthodoxy itself. Indeed, when viewed against a historical situation in which a variety of subversive, interactive and richly hybrid forms are available to the art practitioner, abstractionism assumes the remote and defiant air of an aristocracy that has outlived its age: trammelled by formulaic conventions yet buttressed by a rhetoric of sacred mystery, it seems condemned to being the last citadel of the self-regarding 'fine art' tradition, the last hurrah of painting for painting's sake.

The situation is further complicated in India by the circumstances in which an indigenous abstractionism came into prominence here during the 1960s. From the beginning it was propelled by the dialectic between two motives, one revolutionary and the other conservative-it was inaugurated as an act of emancipation from the dogmas of the nascent Indian nation state, when art was officially viewed as an indulgence at worst, and at best, as an instrument for the celebration of the republic's hopes and aspirations. Having rejected these dogmas, the pioneering abstractionists also went on to reject the various figurative styles associated with the Shantiniketan circle and others. In such a situation, abstractionism was a revolutionary move. It led art towards the exploration of the subconscious mind, the spiritual quest and the possible expansion of consciousness. Indian painting entered into a phase of self-inquiry, a meditative inner space where cosmic symbols and non-representational images ruled. Often, the transition from figurative idioms to abstractionist ones took place within the same artist.

At the same time, Indian abstractionists have rarely committed themselves wholeheartedly to a non-representational idiom. They have been preoccupied with the fundamentally metaphysical project of aspiring to the mystical-holy without altogether renouncing the symbolic. This has been sustained by a hereditary reluctance to give up the *murti*, the inviolable iconic form, which explains why abstractionism is marked by the conservative tendency to operate with images from the sacred repertoire of the past. Abstractionism thus entered India as a double-edged device in a complex cultural transaction. Ideologically, it served as an internationalist legitimisation of the emerging revolutionary local trends. However, on entry, it was conscripted to serve local artistic preoccupations – a survey of indigenous abstractionism will show that its most obvious points of affinity with European and American abstract art were with the more mystically oriented of the major sources of abstractionist philosophy and practice, for instance the Kandinsky-Klee school. There have been no takers for Malevich's Suprematism, which militantly rejected both the artistic forms of the past and the world of appearances, privileging the new-minted geometric symbol as an autonomous sign of the desire for infinity.

Against this backdrop, we can identify three major abstractionist idioms in Indian art. The first develops from a love of the earth, and assumes the form of a celebration of the self's dissolution in the cosmic panorama; the landscape is no longer a realistic transcription of the scene, but is transformed into a visionary occasion for contemplating the cycles of decay and regeneration. The second idiom phrases its departures from symbolic and archetypal devices as invitations to heightened planes of awareness. Abstractionism begins with the establishment or dissolution of the motif, which can be drawn from diverse sources, including the hieroglyphic tablet, the Sufi meditation dance or the Tantric diagram. The third idiom is based on the lyric play of forms guided by gesture or allied with formal improvisations like the assemblage. Here, sometimes, the line dividing abstract image from patterned design or quasi-random expressive marking may blur. The flux of forms can also be regimented through the poetics of pure colour arrangements, vector-diagrammatic spaces and gestural design.

In this genealogy, some pure lines of descent follow their logic to the inevitable point of extinction, others engage in cross-fertilization, and yet others undergo mutation to maintain their energy. However, this genealogical survey demonstrates the wave at its crests, those points where the metaphysical and the painterly have been fused in images of abiding potency, ideas sensuously ordained rather than fabricated programmatically to a concept. It is equally possible to enumerate the thoughts where the two principles do not come together, thus arriving at a very different account. Uncharitable as it may sound, the history of Indian abstractionism records a series of attempts to avoid the risks of abstraction by resorting to an overt and near-generic symbolism, which many Indian abstractionists embrace when they find themselves bereft of the imaginative energy to negotiate the union of metaphysics and painterliness.

Such symbolism falls into a dual trap: it succumbs to the pompous vacuity of pure metaphysics when the burden of intention is passed off as justification; or then it is desiccated by the arid formalism of pure painterliness, with delight in the measure of chance or pattern guiding the execution of a painting. The ensuing conflict of purpose stalls the progress of abstractionism in an impasse. The remarkable Indian abstractionists are precisely those who have overcome this and addressed themselves to the basic elements of their art with a decisive sense of independence from prior models. In their recent work, we see the logic of Indian abstractionism pushed almost to the furthest it can be taken. Beyond such artists stands a lost generation of abstractionists whose work invokes a wistful, delicate beauty but stops there.

Abstractionism is not a universal language; it is an art that points up the loss of a shared language of signs in society. And yet, it affirms the possibility of its recovery through the effort of awareness. While its rhetoric has always emphasised a call for new forms of attention, abstractionist practice has tended to fall into a complacent pride in its own incomprehensibility; a complacency fatal in an ethos where vibrant new idioms compete for the viewers' attention. Indian abstractionists ought to really return to basics, to reformulate and replenish their understanding of the nature of the relationship between the painted image and the world around it. But will they abandon their favourite conceptual habits and formal conventions, if this becomes necessary?

9. *Which one of the following is not stated by the author as a reason for abstractionism losing its vitality?*

- (1) Abstractionism has failed to reorient itself in the context of changing human experience.
- (2) Abstractionism has not considered the developments in artistic expression that have taken place in recent times.
- (3) Abstractionism has not followed the path taken by all revolutions, whether in politics or art.
- (4) The impact of mass media on viewers' expectations has not been assessed, and responded to, by abstractionism.

10. *Which one of the following, according to the author, is the role that abstractionism plays in a society?*

- (1) It provides an idiom that can be understood by most members in a society.
- (2) It highlights the absence of a shared language of meaningful symbols which can be recreated through greater awareness.
- (3) It highlights the contradictory artistic trends of revolution and conservatism that any society needs to move forward.
- (4) It helps abstractionists invoke the wistful, delicate beauty that may exist in society.

11. *According to the author, which one of the following characterises the crisis faced by abstractionism?*

- (1) Abstractionists appear to be unable to transcend the solutions tried out earlier.
- (2) Abstractionism has allowed itself to be confined by set forms and practices.
- (3) Abstractionists have been unable to use the multiplicity of forms now becoming available to an artist.
- (4) All of the above.

12. *According to the author, the introduction of abstractionism was revolutionary because it*

- (1) celebrated the hopes and aspirations of a newly independent nation.
- (2) provided a new direction to Indian art, towards self-inquiry and non-representational images.
- (3) managed to obtain internationalist support for the abstractionist agenda.
- (4) was emancipation from the dogmas of the nascent nation state.

13. *Which one of the following is not part of the author's characterisation of the conservative trend in Indian abstractionism?*

- (1) An exploration of the subconscious mind.
- (2) A lack of full commitment to non-representational symbols.
- (3) An adherence to the symbolic while aspiring to the mystical.
- (4) Usage of the images of gods or similar symbols.

14. *Given the author's delineation to the three abstractionist idioms in Indian art, the third idiom can be best distinguished from the other two idioms through its*

- (1) depiction of nature's cyclical renewal.
- (2) use of non-representational images.
- (3) emphasis on arrangement of forms.
- (4) limited reliance on original models.

15. *According to the author, the attraction of the Kandinsky-Klee school for Indian abstractionist can be explained by which one of the following?*

- (1) The conservative tendency to aspire to the mystical without a complete renunciation of the symbolic.
- (2) The discomfort of Indian abstractionists with Malevich's Suprematism.
- (3) The easy identification of obvious points of affinity with European and American abstract art, of which the Kandinsky-Klee school is an example.
- (4) The double-edged nature of abstractionism which enabled identification with mystically-oriented schools.

16. *Which one of the following, according to the author, is the most important reason for the stalling of abstractionism's progress in an impasse?*

- (1) Some artists have followed their abstractionist logic to the point of extinction.
- (2) Some artists have allowed chance or pattern to dominate the execution of their paintings.
- (3) Many artists have avoided the trap of a near-generic and an open symbolism.
- (4) Many artists have found it difficult to fuse the twin principles of the metaphysical and the painterly.

PASSAGE III

In a modern computer, electronic and magnetic storage technologies play complementary roles. Electronic memory chips are fast but volatile (their contents are lost when the computer is unplugged). Magnetic tapes and hard disks are slower, but have the advantage that they are non-volatile, so that they can be used to store software and documents even when the power is off.

In laboratories around the world, however, researchers are hoping to achieve the best of both worlds. They are trying to build magnetic memory chips that could be used in place of today's electronic ones. These magnetic memories would be non-volatile; but they would also be faster, would consume less power, and would be able to stand up to hazardous environments more easily. Such chips would have obvious applications in storage cards for digital cameras and music-players; they would enable hand-held and laptop computers to boot up more quickly and to operate for longer; they would allow desktop computers to run faster; they would doubtless have military and space-faring advantages too. But although the theory behind them looks solid, there are tricky practical problems and need to be overcome.

Two different approaches, based on different magnetic phenomena, are being pursued. The first, being investigated by Gary Prinz and his colleagues at the Naval Research Laboratory (NRL) in Washington, D.C., exploits the fact that the electrical resistance of some materials changes in the presence of a magnetic field—a phenomenon known as magneto-resistance. For some multi-layered materials this effect is particularly powerful and is, accordingly, called “giant” magneto-resistance (GMR). Since 1997, the exploitation of GMR has made cheap multi-gigabyte hard disks commonplace. The magnetic orientations of the magnetised spots on the surface of a spinning disk are detected by measuring the changes they induce in the resistance of a tiny sensor. This technique is so sensitive that it means the spots can be made smaller and packed closer together than was previously possible, thus increasing the capacity and reducing the size and cost of a disk drive.

Dr. Prinz and his colleagues are now exploiting the same phenomenon on the surface of memory chips, rather than spinning disks. In a conventional memory chip, each binary digit (bit) of data is represented using a capacitor-reservoir of electrical charge that is either empty or full—to represent a zero or a one. In the NRL's magnetic design, by contrast, each bit is stored in a magnetic element in the form of a vertical pillar of magnetisable material. A matrix of wires passing above and below the elements allows each to be magnetised, either clockwise or anti-clockwise, to represent zero or one. Another set of wires allows current to pass through any particular element. By measuring an element's resistance you can determine its magnetic orientation, and hence whether it is storing a zero or a one. Since the elements retain their magnetic orientation even when the power is off, the result is non-volatile memory. Unlike the elements of an electronic memory, a magnetic memory's elements are not easily disrupted by radiation. And compared with electronic memories, whose capacitors need constant topping up, magnetic memories are simpler and consume less power. The NRL researchers plan to commercialise their device through a company called Non-Volatile Electronics, which recently began work on the necessary processing and fabrication techniques. But it will be some years before the first chips roll off the production line.

Most attention in the field is focused on an alternative approach based on magnetic tunnel-junctions (MTJs), which are being investigated by researchers at chip makers such as IBM, Motorola, Siemens and Hewlett-Packard. IBM's research team, led by Stuart Parkin, has already created a 500-element working prototype that operates at 20 times the speed of conventional memory chips and consumes 1 % of the power. Each element consists of a sandwich of two layers of magnetisable material separated by a barrier of aluminium oxide just

four or five atoms thick. The polarisation of lower magnetisable layer is fixed in one direction, but that of the upper layer can be set (again, by passing a current through a matrix of control wires) either to the left or to the right, to store a zero or a one. The polarisations of the two layers are then in either the same or opposite directions.

Although the aluminium-oxide barrier is an electrical insulator, it is so thin that electrons are able to jump across it via a quantum-mechanical effect called tunnelling. It turns out that such tunnelling is easier when the two magnetic layers are polarised in the same direction than when they are polarised in opposite directions. So, by measuring the current that flows through the sandwich, it is possible to determine the alignment of the topmost layer, and hence whether it is storing a zero or a one.

To build a full-scale memory chip based on MTJs is, however, no easy matter. According to Paulo Freitas, an expert on chip manufacturing at the Technical University of Lisbon, magnetic memory elements will have to become far smaller and more reliable than current prototypes if they are to compete with electronic memory. At the same time, they will have to be sensitive enough to respond when the appropriate wires in the control matrix are switched on, but not so sensitive that they respond when a neighbouring element is changed. Despite these difficulties, the general consensus is that MTJs are the more promising ideas. Dr. Parkin says his group evaluated the GMR approach and decided not to pursue it, despite the fact that IBM pioneered GMR in hard disks. Dr. Prinz, however, contends that his plan will eventually offer higher storage densities and lower production costs.

Not content with shaking up the multi-billion-dollar market for computer memory, some researchers have even more ambitious plans for magnetic computing. In a paper published last month in *Science*, Russell Cowburn and Mark Welland at Cambridge University outlined research that could form the basis of a magnetic microprocessor- a chip capable of manipulating (rather than merely storing) information magnetically. In place of conducting wires, a magnetic processor would have rows of magnetic dots, each of which could be polarised in one of two directions. Individual bits of information would travel down the rows as magnetic pulses, changing the orientation of the dots as they went. Dr. Cowburn and Dr. Welland have demonstrated how a logic gate (the basic element of a microprocessor) could work in such a scheme. In their experiment, they fed a signal in at one end of the chain of dots and used a second signal to control whether it propagated along the chain.

It is, admittedly, a long way from a single logic gate to a full microprocessor, but this was true also when the transistor was first invented. Dr. Cowburn, who is now searching for backers to help commercialise the technology, says he believes it will be at least ten years before the first magnetic microprocessor is constructed. But other researchers in the field agree that such a chip is the next logical step. Dr. Prinz says that once magnetic memory is sorted out “the target is to go after the logic circuits.” Whether all-magnetic computers will ever be able to compete with other contenders that are jostling to knock electronics off its perch-such as optical, biological and quantum computing-remains to be seen. Dr. Cowburn suggests that the future lies with hybrid machines that use different technologies. But computing with magnetism evidently has an attraction all its own.

17. *In developing magnetic memory chips to replace the electronic ones, two alternative research paths are being pursued. These are approaches based on*

- (1) volatile and non-volatile memories.
- (2) magneto-resistance and magnetic tunnel-junctions.
- (3) radiation-disruption and radiation-neutral effects.
- (4) orientation of magnetised spots on the surface of a spinning disk and alignment of magnetic dots on the surface of a conventional memory chip.

18. *A binary digit or bit is represented in the magneto-resistance based magnetic chip using*

- | | |
|---|------------------------|
| (1) a layer of aluminium oxide. | (2) a capacitor. |
| (3) a vertical pillar of magnetised material. | (4) a matrix of wires. |

19. *In the magnetic tunnel-junctions (MTJs) tunnelling is easier when*

- (1) two magnetic layers are polarised in the same direction.
- (2) two magnetic layers are polarised in the opposite directions.
- (3) two aluminium-oxide barriers are polarised in the same direction.
- (4) two aluminium-oxide barriers are polarised in opposite directions.

20. *A major barrier on the way to build a full-scale memory chip based on MTJs is*

- (1) the low sensitivity of the magnetic memory elements.
- (2) the thickness of aluminium oxide barriers.
- (3) the need to develop more reliable and far smaller magnetic memory chips.
- (4) all of the above.

21. *In the MTJs approach, it is possible to identify whether the topmost layer of the magnetised memory element is storing a zero or one by*

- (1) measuring an element's resistance and thus determining its magnetic orientation.
- (2) measuring the degree of disruption caused by radiation in the elements of the magnetic memory.
- (3) magnetising the elements either clockwise or anti-clockwise.
- (4) measuring the current that flows through the sandwich.

22. *A line of research which is trying to build a magnetic chip that can both store and manipulate information, is being pursued by*

- | | | | |
|------------------|-------------------|----------------|-------------------|
| (1) Paul Freitas | (2) Stuart Parkin | (3) Gary Prinz | (4) None of these |
|------------------|-------------------|----------------|-------------------|

23. *Experimental research currently underway, using rows of magnetic dots, each of which could be polarised in one of the two directions, has led to the demonstration of*

- (1) working of a microprocessor.
- (2) working of a logic gate.
- (3) working of a magneto-resistance based chip.
- (4) working of a magneto tunnelling-junction (MTJ) based chip.

24. *From the passage, which of the following cannot be inferred?*

- (1) Electronic memory chips are faster and non-volatile.
- (2) Electronic and magnetic storage technologies play a complementary role.
- (3) MTJs are the more promising idea, compared to the magneto-resistance approach.
- (4) Non-volatile Electronics is the company set up to commercialise the GMR chips.

PASSAGE IV

The story begins as the European pioneers crossed the Alleghenies and started to settle in the Midwest. The land they found was covered with forests. With incredible effort they felled the trees, pulled the stumps and planted their crops in the rich, loamy soil. When they finally reached the western edge of the place we now call Indiana, the forest stopped and ahead lay a thousand miles of the great grass prairie. The Europeans were puzzled by this new environment. Some even called it the "Great Desert". It seemed untillable. The earth was often very wet and it was covered with centuries of tangled and matted grasses. With their cast iron plows, the settlers found that the prairie sod could not be cut and the wet earth stuck to their plowshares. Even a team of the best oxen bogged down after a few years of tugging. The iron plow was a useless tool to farm the prairie soil. The pioneers were stymied for nearly two decades. Their western march was halted and they filled in the eastern regions of the Midwest.

In 1837, a blacksmith in the town of Grand Detour, Illinois, invented a new tool. His name was John Deere and the tool was a plow made of steel. It was sharp enough to cut through matted grasses and smooth enough to cast off the mud. It was a simple tool, the "sod buster" that opened the great prairies to agricultural development.

Sauk County, Wisconsin is the part of that prairie where I have a home. It is named after the Sauk Indians. In 1673, Father Marquette was the first European to lay his eyes upon their land. He found a village laid out in regular patterns on a plain beside the Wisconsin River. He called the place Prairie du Sac. The village was surrounded by fields that had provided maize, beans and squash for the Sauk people for generations reaching back into the unrecorded time.

When the European settlers arrived at the Sauk prairie in 1837, the government forced the native Sauk people west of the Mississippi River. The settlers came with John Deere's new invention and used the tool to open the area to a new kind of agriculture. They ignored the traditional ways of the Sauk Indians and used their sod-busting tool for planting wheat. Initially, the soil was generous and the farmers thrived. However, each year the soil lost more of its nurturing power. It was only thirty years after the Europeans arrived with their new technology that the land was depleted. Wheat farming became uneconomic and tens of thousands of farmers left Wisconsin seeking new land with sod to bust.

It took the Europeans and their new technology just one generation to make their homeland into a desert. The Sauk Indians who knew how to sustain themselves on the Sauk prairie land were banished to another kind of desert called a reservation. And they even forgot about the techniques and tools that had sustained them on the prairie for generations unrecorded. And that is how it was that three deserts were created-Wisconsin, the reservation and the memories of a people. A century later, the land of the Sauks is now populated by the children of a second wave of European farmers who learned to replenish the soil through the regenerative powers of dairying, ground cover crops and animal manures. These third and fourth generation farmers and townspeople do not realise, however, that a new settler is coming soon with an invention as powerful as John Deere's plow.

The new technology is called 'bereavement counselling'. It is a tool forged at the great state university, an innovative technique to meet the needs of those experiencing the death of a loved one, a tool that can "process" the grief of the people who now live on the Prairie of the Sauk. As one can imagine the final days of the village of the Sauk Indians before the arrival of the settlers with John Deere's plow, one can also imagine these final days before the arrival of the first bereavement counsellor at Prairie du Sac. In these final days, the farmers and

the townspeople mourn at the death of a mother, brother, son or friend. The bereaved is joined by neighbours and kin. They meet grief together in lamentation, prayer and song. They call upon the words of the clergy and surround themselves in community.

It is in these ways that they grieve and then go on with life. Through their mourning they are assured of the bonds between them and renewed in the knowledge that this death is a part of the Prairie of the Sauk. Their grief is common property, anguish from which the community draws strength and gives the bereaved the courage to move ahead.

It is into this prairie community that the bereavement counsellor arrives with the new grief technology. The counsellor calls the invention a service and assures the prairie folk of its effectiveness and superiority by invoking the name of the great university while displaying a diploma and certificate. At first, we can imagine that the local people will be puzzled by the bereavement counsellor's claim. However, the counsellor will tell a few of them that the new technique is merely to assist the bereaved's community at the time of death. To some other prairie folk who are isolated or forgotten, the counsellor will approach the County Board and advocate the right to treatment for these unfortunate souls. This right will be guaranteed by the Board's decision to reimburse those too poor to pay for counselling services. There will be others, schooled to believe in the innovative new tools certified by universities and medical centres, who will seek out the bereavement counsellor by force of habit. And one of these people will tell a bereaved neighbour who is unschooled that unless his grief is processed by a counsellor, he will probably have major psychological problems in later life. Several people will begin to use the bereavement counsellor because, since the County Board now taxes them to insure access to the technology, they will feel that to fail to be counselled is to waste their money, and to be denied a benefit, or even a right.

Finally, one day, the aged father of a Sauk woman will die. And the next door neighbour will not drop by because he doesn't want to interrupt the bereavement counsellor. The woman's kin will stay home because they will have learned that only the bereavement counsellor knows how to process grief the proper way. The local clergy will seek technical assistance from the bereavement counsellor to learn the correct form of service to deal with guilt and grief. And the grieving daughter will know that it is the bereavement counsellor who really cares for her because only the bereavement counsellor comes when death visits this family on the Prairie of the Sauk.

It will be only one generation between the bereavement counsellor arrives and the community of mourners disappears. The counsellor's new tool will cut through the social fabric, throwing aside kinship, care, neighbourly obligations and community ways of coming together and going on. Like John Deere's plow, the tools of bereavement counselling will create a desert where a community once flourished. And finally, even the bereavement counsellor will see the impossibility of restoring hope in clients once they are genuinely alone with nothing but a service for consolation. In the inevitable failure of the service, the bereavement counsellor will find the deserts even in herself.

25. *Which one of the following best describes the approach of the author?*

- (1) Comparing experiences with two innovations tried, in order to illustrate the failure of both.
- (2) Presenting community perspectives on two technologies which have had negative effects on people.
- (3) Using the negative outcomes of one innovation to illustrate the likely outcomes of another innovation.
- (4) Contrasting two contexts separated in time, to illustrate how 'deserts' have arisen.

26. *According to the passage, bereavement handling traditionally involves*

- (1) the community bereavement counsellors working with the bereaved to help him/her overcome grief.
- (2) the neighbours and kin joining the bereaved and meeting grief together in mourning and prayer.
- (3) using techniques developed systematically in formal institutions of learning, a trained counsellor helping the bereaved cope with grief.
- (4) the Sauk Indian Chief leading the community with rituals and rites to help lessen the grief of the bereaved.

27. *Due to which of the following reasons, according to the author, will the bereavement counsellor find the deserts even in herself?*

- (1) Over a period of time, working with Sauk Indians who have lost their kinship and relationships, she becomes one of them.
- (2) She is working in an environment where the disappearance of community mourners makes her work place a social desert.
- (3) Her efforts at grief processing with the bereaved will fail as no amount of professional service can make up for the loss due to the disappearance of community mourners.
- (4) She has been working with people who have settled for a long time in the Great Desert.

28. *According to the author, the bereavement counsellor is*

- (1) a friend of the bereaved helping him or her handle grief.
- (2) an advocate of the right to treatment for the community.
- (3) a kin of the bereaved helping him/her handle grief.
- (4) a formally trained person helping the bereaved handle grief.

29. *The Prairie was a great puzzlement for the European pioneers because*

- (1) it was covered with thick, untillable layers of grass over a vast stretch.
- (2) it was a large desert immediately next to lush forests.
- (3) it was rich cultivable land left fallow for centuries.
- (4) it could be easily tilled with iron plows.

30. *Which of the following does the 'desert' in the passage refer to?*

- (1) Prairie soil depleted by cultivation of wheat.
- (2) Reservations in which native Indians were resettled.
- (3) Absence of, and emptiness in, community kinship and relationships.
- (4) All of the above.

31. *According to the author, people will begin to utilise the service of the bereavement counsellor because*

- (1) new County regulations will make them feel it is a right, and if they don't use it, it would be a loss.
- (2) the bereaved in the community would find her a helpful friend.
- (3) she will fight for subsistence allowance from the County Board for the poor among the bereaved.
- (4) grief processing needs tools certified by universities and medical centres.

32. *Which one of the following parallels between the plow and bereavement counselling is not claimed by the author?*

- (1) Both are innovative technologies.
- (2) Both result in migration of the communities into which the innovations are introduced.
- (3) Both lead to 'deserts' in the space of only one generation.
- (4) Both are tools introduced by outsiders entering existing communities.

PASSAGE V

The teaching and transmission of North Indian classical music is, and long has been, achieved by largely oral means. The *raga* and its structure, the often breathtaking intricacies of *tala* or rhythm, and the incarnation of *raga* and *tala* as *bandish* or composition, are passed thus, between *guru* and *shishya* by word of mouth and direct demonstration, with no printed sheet of notated music, as it were, acting as a go-between. Saussure's conception of language as a communication between addresser and addressee is given, in this model, a further instance, and a new exotic complexity and glamour.

These days, especially with the middle class having entered the domain of classical music and playing not a small part in ensuring the continuation of this ancient tradition, the tape recorder serves as a handy technological slave and preserves, from oblivion, the vanishing, elusive moment of oral transmission. Hoary *gurus*, too, have seen the advantage of this device, and increasingly use it as an aid to instructing their pupils; in place of the *shawls* and other traditional objects that used to pass from *shishya* to *guru* in the past, as a token of the regard of the former for the latter, it is not unusual, today, to see cassettes changing hands.

Part of my education in North Indian classical music was conducted via this rather ugly but beneficial rectangle of plastic, which I carried with me to England when I was an undergraduate. One cassette had stored in it various *talas* played upon the *tabla*, at various tempos, by my music teacher's brother-in-law, Hazarilalji, who was a teacher of *Kathak* dance, as well as a singer and a *tabla* player. This was a work of great patience and prescience, a one-and-a-half hour performance without any immediate point or purpose, but intended for some delayed future moment when I'd practise the *talas* solitarily.

This repeated playing out of the rhythmic cycles on the *tabla* was inflected by the noises—an irate auto driver blowing a horn; the sound of overbearing pigeons that were such a nuisance on the banister; even the cry of a *kulfi* seller in summer-entering from the balcony of the third floor flat we occupied in those days, in a lane in a Bombay suburb, before we left the city for good. These sounds, in turn, would invade, hesitantly, the ebb and flow of silence inside the artificially heated room, in a borough of West London, in which I used to live as an undergraduate. There, in the trapped dust, silence and heat, the *theka* of the *tabla*, qualified by the imminent but intermittent presence of the Bombay suburb, would come to life again. A few years later, the *tabla* and, in the background, the pigeons and the itinerant *kulfi* seller, would inhabit a small graduate room in Oxford.

The tape recorder, though, remains an extension of the oral transmission of music, rather than a replacement of it. And the oral transmission of North Indian classical music remains, almost uniquely, a testament to the fact that the human brain can absorb, remember and reproduce structures of great complexity and sophistication without the help of the hieroglyph or written mark or a system of notation. I remember my surprise on discovering that Hazarilalji—who had mastered *Kathak* dance, *tala* and North Indian classical music, and who used to narrate to me, occasionally, compositions meant for dance that were grand and intricate in their verbal prosody, architecture and rhythmic complexity—was near illiterate and had barely learnt to write his name in large and clumsy letters.

Of course, attempts have been made, throughout the 20th century, to formally codify and even notate this music, and institutions set up and degrees created, specifically to educate students in this “scientific” and codified manner. Paradoxically, however, this style of teaching has produced no noteworthy student or performer; the most creative musicians still emerge from the *guru-shishya* relationship, their understanding of music developed by oral communication.

The fact that North Indian classical music emanates from, and has evolved through, oral culture, means that this music has a significantly different aesthetic, and that this aesthetic has a different politics, from that of Western classical music. A piece of music in the Western tradition, at least in its most characteristic and popular conception, originates in its composer, and the connection between the two, between composer and the piece of music, is relatively unambiguous precisely because the composer writes down, in notation, his composition, as a poet might write down and publish his poem. However far the printed sheet of notated music might travel thus from the composer, it still remains his property; and the notion of property remains at the heart of the Western conception of “genius”, which derives from the Latin *gignere* or ‘to beget’.

The genius in Western classical music is, then, the originator, begetter and owner of his work-the printed, notated sheet testifying to his authority over his product and his power, not only of expression or imagination, but of origination. The conductor is a custodian and guardian of this property. Is it an accident that Mandelstam, in his notebooks, compares-celebratorily-the conductor’s baton to a policeman’s, saying all the music of the orchestra lies mute within it, waiting for its first movement to release it into the auditorium?

The *raga*-transmitted through oral means is, in a sense, no one’s property; it is not easy to pin down its source, or to know exactly where its provenance or origin lies. Unlike the Western classical tradition, where the composer begets his piece, notates it and stamps it with his ownership and remains, in effect, larger than, or the father of, his work, in the North Indian classical tradition, the *raga*-unconfined to a single incarnation, composer or performer-remains necessarily greater than the artiste who invokes it.

This leads to a very different politics of interpretation and valuation, to an aesthetic that privileges the evanescent moment of performance and invocation over the controlling authority of genius and the permanent record. It is a tradition, thus, that would appear to value the performer, as medium, more highly than the composer who presumes to originate what, effectively, cannot be originated in a single person-because the *raga* is the inheritance of a culture.

33. *The author's contention that the notion of property lies at the heart of the Western conception of genius is best indicated by which one of the following?*

- (1) The creative output of a genius is invariably written down and recorded.
- (2) The link between the creator and his output is unambiguous.
- (3) The word "genius" is derived from a Latin word which means "to beget."
- (4) The music composer notates his music and thus becomes the "father" of a particular piece of music.

34. *Saussure's conception of language as a communication between addresser and addressee, according to the author, is exemplified by the*

- (1) teaching of North Indian classical music by word of mouth and direct demonstration.
- (2) use of the recorded cassette as a transmission medium between the music teacher and the trainee.
- (3) written down notation sheets of musical compositions.
- (4) conductor's baton and the orchestra.

35. *The author holds that the "rather ugly but beneficial rectangle of plastic" has proved to be a "handy technological slave" in*

- (1) storing the talas played upon the tabla, at various tempos.
- (2) ensuring the continuance of an ancient tradition.
- (3) transporting North Indian classical music across geographical borders.
- (4) capturing the transient moment of oral transmission.

36. *The oral transmission of North Indian classical music is an almost unique testament of the*

- (1) efficacy of the guru-shishya tradition.
- (2) earning impact of direct demonstration.
- (3) brain's ability to reproduce complex structures without the help of written marks.
- (4) the ability of an illiterate person to narrate grand and intricate musical compositions.

37. *According to the passage, in the North Indian classical tradition, the raga remains greater than the artiste who invokes it. This implies an aesthetic which*

- (1) emphasises performance and invocation over the authority of genius and permanent record.
- (2) makes the music no one's property.
- (3) values the composer more highly than the performer.
- (4) supports oral transmission of traditional music.

38. From the author's explanation of the notion that in the Western tradition, music originates in its composer, which one of the following cannot be inferred?

- (1) It is easy to transfer a piece of Western classical music to a distant place.
- (2) The conductor in the Western tradition, as a custodian, can modify the music, since it 'lies mute' in his baton.
- (3) The authority of the Western classical music composer over his music product is unambiguous.
- (4) The power of the Western classical music composer extends to the expression of his music.

39. According to the author, the inadequacy of teaching North Indian classical music through a codified, notation based system is best illustrated by

- (1) a loss of the structural beauty of the ragas.
- (2) a fusion of two opposing approaches creating mundane music.
- (3) the conversion of free-flowing ragas into stilted set pieces.
- (4) its failure to produce any noteworthy student or performer.

40. Which of the following statements best conveys the overall idea of the passage?

- (1) North Indian and Western classical music are structurally different.
- (2) Western music is the intellectual property of the genius while the North Indian raga is the inheritance of a culture.
- (3) Creation as well as performance are important in the North Indian classical tradition.
- (4) North Indian classical music is orally transmitted while Western classical music depends on written down notations.

DIRECTIONS: Sentences given in each question, when properly sequenced, form a coherent paragraph. The first and last sentences are 1 and 6, and the four in between are labelled A, B, C and D. Choose the most logical order of these four sentences from among the four given choices to construct a coherent paragraph from sentences 1 to 6.

41. 1. Security inks exploit the same principle that causes the vivid and constantly changing colours of a film of oil on water.
- A. When two rays of light meet each other after being reflected from these different surfaces, they have each travelled slightly different distances.
 - B. The key is that the light is bouncing off two surfaces, that of the oil and that of the water layer below it.
 - C. The distance the two rays travel determines which wavelengths, and hence colours, interfere constructively and look bright.
 - D. Because light is an electromagnetic wave, the peaks and troughs of each ray then interfere either constructively, to appear bright, or destructively, to appear dim.
6. Since the distance the rays travel changes with the angle as you look at the surface, different colours look bright from different viewing angles.

(1) ABCD

(2) BADC

(3) BDAC

(4) DCAB

42. 1. Commercially reared chicken can be unusually aggressive, and are often kept in darkened sheds to prevent them pecking at each other.
- A. The birds spent far more of their time-up to a third-pecking at the inanimate objects in the pens, in contrast to birds in other pens which spent a lot of time attacking others.
 - B. In low light conditions, they behave less belligerently, but are more prone to ophthalmic disorders and respiratory problems.
 - C. In an experiment, aggressive head-pecking was all but eliminated among birds in the enriched environment.
 - D. Altering the birds' environment, by adding bales of wood-shavings to their pens, can work wonders.
6. Bales could diminish aggressiveness and reduce injuries; they might even improve productivity, since a happy chicken is a productive chicken.

(1) DCAB

(2) CDBA

(3) DBAC

(4) BDCA

43. 1. The concept of a 'nation-state' assumes a complete correspondence between the boundaries of the nation and the boundaries of those who live in a specific state.
- A. Then there are members of national collectivities who live in other countries, making a mockery of the concept.
 - B. There are always people living in particular states who are not considered to be (and often do not consider themselves to be) members of the hegemonic nation.
 - C. Even worse, there are nations which never had a state or which are divided across several states.
 - D. This, of course, has been subject to severe criticism and is virtually everywhere a fiction.
6. However, the fiction has been, and continues to be, at the basis of nationalist ideologies.

(1) DBAC

(2) ABCD

(3) BACD

(4) DACB

44. 1. In the sciences, even questionable examples of research fraud are harshly punished.
- A. But no such mechanism exists in the humanities-much of what humanities researchers call, research does not lead to results that are replicable by other scholars.
 - B. Given the importance of interpretation in historical and literary scholarship, humanities researchers are in a position where they can explain away deliberate and even systematic distortion.
 - C. Mere suspicion is enough for funding to be cut off; publicity guarantees that careers can be effectively ended.
 - D. Forgeries which take the form of pastiches in which the forger intersperses fake and real parts can be defended as mere mistakes or aberrant misreading.
6. Scientists fudging data have no such defences.

(1) BDCA

(2) ABDC

(3) CABD

(4) CDBA

45. 1. Horses and communism were, on the whole, a poor match.
- A. Fine horses bespoke the nobility the party was supposed to despise.
 - B. Communist leaders, when they visited villages, preferred to see cows and pigs.
 - C. Although a working horse was just about tolerable, the communists were right to be wary.
 - D. Peasants from Poland to the Hungarian Pustza preferred their horses to party dogma.
6. 'A farmer's pride is his horse; his cow may be thin but his horse must be fat,' went a Slovak saying.

(1) ACDB

(2) DBCA

(3) ABCD

(4) DCBA

DIRECTIONS : In each of the following sentences, parts of the sentence are left blank. Beneath each sentence, four different ways of completing the sentence are indicated. Choose the best alternative from among the four.

46. Though one eye is kept firmly on the , the company now also promotes contemporary art.

(1) present, experimental

(2) future, popular

(3) present, popular

(4) market, popular

47. The law prohibits a person from felling a sandalwood tree, even if it grows on one's own land, without prior permission from the government. As poor people cannot deal with the government, this legal provision leads to a rip-roaring business for, who care neither for the, nor for the trees.

(1) middlemen, rich

(2) the government, poor

(3) touts, rich

(4) touts, poor

48. It will take some time for many South Koreans to the conflicting images of North Korea, let alone to what to make of their northern cousins.

(1) reconcile, decide

(2) understand, clarify

(3) make out, decide

(4) reconcile, understand

49. In these bleak and depressing times of prices, non-performing governments and crime rates, Sourav Ganguly has given us, Indians, a lot to cheer about.

(1) escalating, increasing

(2) spiralling, booming

(3) spiralling, soaring

(4) ascending, debilitating

50. The manners and of the nouveau riche is a recurrent in the literature.

(1) style, motif

(2) morals, story

(3) wealth, theme

(4) morals, theme

DIRECTIONS : The sentences given in each question, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a letter. Choose the most logical order of sentences from among the four given choices to construct a coherent paragraph.

51.

- A. If caught in the act, they were punished, not for the crime, but for allowing themselves to be caught another lash of the whip.
- B. The bellicose Spartans sacrificed all the finer things in life for military expertise.
- C. Those fortunate enough to survive babyhood were taken away from their mothers at the age of seven to undergo rigorous military training.
- D. This consisted mainly of beatings and deprivations of all kinds like going around barefoot in winter, and worse, starvation so that they would be forced to steal food to survive.
- E. Male children were examined at birth by the city council and those deemed too weak to become soldiers were left to die of exposure.

(1) BECDA

(2) ECADB

(3) BCDAE

(4) ECDAB

52.

- A. This very insatiability of the photographing eye changes the terms of confinement in the cave, our world.
- B. Humankind lingers unregenerately in Plato's cave, still revelling its age-old habit, in mere images of truth.
- C. But being educated by photographs is not like being educated by older images drawn by hand; for one thing, there are a great many more images around, claiming our attention.
- D. The inventory started in 1839 and since then just about everything has been photographed, or so it seems.
- E. In teaching us a new visual code, photographs alter and enlarge our notions of what is worth looking at and what we have a right to observe.

(1) EABCD

(2) BDEAC

(3) BCDAE

(4) ECDAB

53.

- A. To be culturally literate is to possess the basic information needed to thrive in the modern world.
- B. Nor is it confined to one social class; quite the contrary.
- C. It is by no means confined to "culture" narrowly understood as an acquaintance with the arts.
- D. Cultural literacy constitutes the only sure avenue of opportunity for disadvantaged children, the only reliable way of combating the social determinism that now condemns them.
- E. The breadth of that information is great, extending over the major domains of human activity from sports to science.

(1) AECBD

(2) DECBA

(3) ACBED

(4) DBCAE

54.

- A. Both parties use capital and labour in the struggle to secure property rights.
- B. The thief spends time and money in his attempt to steal (he buys wire cutters) and the legitimate property owner expends resources to prevent the theft (he buys locks)
- C. A social cost of theft is that both the thief and the potential victim use resources to gain or maintain control over property.
- D. These costs may escalate as a type of technological arms race unfolds.
- E. A bank may purchase more and more complicated and sophisticated safes, forcing safecrackers to invest further in safecracking equipment.

(1) ABCDE

(2) CABDE

(3) ACBED

(4) CBEDA

55.

- A. The likelihood of an accident is determined by how carefully the motorist drives and how carefully the pedestrian crosses the street.
- B. An accident involving a motorist and a pedestrian is such a case.
- C. Each must decide how much care to exercise without knowing how careful the other is.
- D. The simplest strategic problem arises when two individuals interact with each other, and each must decide what to do without knowing what the other is doing.

(1) ABCD

(2) ADCB

(3) DBCA

(4) DBAC

SECTION II

Number of Questions: 55

DIRECTIONS: Answer each of the questions independently.

56. Let D be a recurring decimal of the form, $D = 0.a_1 a_2 a_1 a_2 a_1 a_2 \dots$, where digits a_1 and a_2 lie between 0 and 9. Further, at most one of them is zero. Then which of the following numbers necessarily produces an integer, when multiplied by D ?

- (1) 18 (2) 108 (3) 198 (4) 288

57.

x	1	2	3	4	5	6
y	4	8	14	22	32	44

In the above table, for suitably chosen constants a , b and c , which one of the following best describes the relation between y and x ?

- (1) $y = a + bx$ (2) $y = a + bx + cx^2$ (3) $y = e^{a+bx}$ (4) None of the above

58. If $a_1 = 1$ and $a_{n+1} = 2a_n + 5$, $n = 1, 2 \dots$, then a_{100} is equal to

- (1) $(5 \times 2^{99} - 6)$ (2) $(5 \times 2^{99} + 6)$ (3) $(6 \times 2^{99} + 5)$ (4) $(6 \times 2^{99} - 5)$

59. What is the value of the following expression?

$$\left(\frac{1}{2^2 - 1}\right) + \left(\frac{1}{4^2 - 1}\right) + \left(\frac{1}{6^2 - 1}\right) + \dots + \left(\frac{1}{20^2 - 1}\right)$$

- (1) 9/19 (2) 10/19 (3) 10/21 (4) 11/21

60. A truck travelling at 70 kilometres per hour uses 30% more diesel to travel a certain distance than it does when it travels at the speed of 50 kilometres per hour. If the truck can travel 19.5 kilometres on a litre of diesel at 50 kilometres per hour, how far can the truck travel on 10 litres of diesel at a speed of 70 kilometres per hour?

- (1) 130 (2) 140 (3) 150 (4) 175

61. Consider a sequence of seven consecutive integers. The average of the first five integers is n . The average of all the seven integers is

- (1) n (2) $n + 1$
(3) $K \times n$, where k is a function of n (4) $n + (2/7)$

62. If $x > 2$ and $y > -1$, Then which of the following statements is necessarily true?

- (1) $xy > -2$ (2) $-x < 2y$ (3) $xy < -2$ (4) $-x > 2y$

71. The table below shows the age-wise distribution of the population of Reposia. The number of people aged below 35 years is 400 million.

Age group	Percentages
Below 15 years	30.00
15 - 24	17.75
25 - 34	17.00
35 - 44	14.50
45 - 54	12.50
55 - 64	7.10
65 and above	1.15

If the ratio of females to males in the 'below 15 years' age group is 0.96, then what is the number of females (in millions) in that age group?

- (1) 82.8 (2) 90.8 (3) 80.0 (4) 90.0
72. Sam has forgotten his friend's seven-digit telephone number. He remembers the following the first three digits are either 635 or 674, the number is odd, and the number nine appears once. If sam were to use a trial and error process to reach his friend, what is the minimum number of trials he has to make before he can be certain to succeed?

- (1) 1000 (2) 2430 (3) 3402 (4) 3006

For Q.73 & Q.74 :

A, B, C are three numbers. Let

@ (A, B) = average of A and B,

/ (A, B) = product of A and B, and

X (A, B) = the result of dividing A by B

73. The sum of A and B is given by

- (1) /(@ (A, B), 2) (2) X(@ (A, B), 2) (3) @(/(A, B), 2) (4) @ (X(A, B), 2)

74. Average of A, B and C is given by

- (1) @(/@(/B, A), 2), C), 3)
 (2) X(/@(/@ (B, A), 3), C), 2)
 (3) / ((X(@ (B, A), 2), C), 3)
 (4) / (X(@(/@ (B, A), 2), C), 3), 2)

For Q.75 & Q.76 :

For real numbers x, y , let
 $f(x, y)$ = Positive square-root of $(x + y)$,
if $(x + y)^{0.5}$ is real = $(x + y)^2$, otherwise
 $g(x, y) = (x + y)^2$,
if $(x + y)^{0.5}$ is real = $-(x + y)$, otherwise

75. Which of the following expressions yields a positive value for every pair of non-zero real number (x, y) ?

- (1) $f(x, y) - g(x, y)$ (2) $f(x, y) - (g(x, y))^2$
(3) $g(x, y) - (f(x, y))^2$ (4) $f(x, y) + g(x, y)$

76. Under which of the following conditions is $f(x, y)$ necessarily greater than $g(x, y)$?

- (1) Both x and y are less than -1 (2) Both x and y are positive
(3) Both x and y are negative (4) $y > x$

For Q.77 to Q.79 :

For three distinct real numbers x, y and z , let
 $f(x, y, z) = \min (\max (x, y), \max (y, z), \max (z, x))$
 $g(x, y, z) = \max (\min (x, y), \min (y, z), \min (z, x))$
 $h(x, y, z) = \max (\max (x, y), \max (y, z), \max (z, x))$
 $j(x, y, z) = \min (\min (x, y), \min (y, z), \min (z, x))$
 $m(x, y, z) = \max (x, y, z)$
 $n(x, y, z) = \min (x, y, z)$

77. Which of the following is necessarily greater than 1?

- (1) $(h(x, y, z) - f(x, y, z)) / j(x, y, z)$ (2) $j(x, y, z) / h(x, y, z)$
(3) $f(x, y, z) / g(x, y, z)$ (4) $(f(x, y, z) + h(x, y, z) - g(x, y, z)) / j(x, y, z)$

78. Which of the following expressions is necessarily equal to 1?

- (1) $(f(x, y, z) - m(x, y, z)) / (g(x, y, z) - h(x, y, z))$ (2) $(m(x, y, z) - f(x, y, z)) / (g(x, y, z) - n(x, y, z))$
(3) $(j(x, y, z) - g(x, y, z)) / h(x, y, z)$ (4) $(f(x, y, z) - h(x, y, z)) / f(x, y, z)$

79. Which of the following expressions is indeterminate?

- (1) $(f(x, y, z) - h(x, y, z)) / (g(x, y, z) - j(x, y, z))$
(2) $(f(x, y, z) + h(x, y, z) + g(x, y, z) + j(x, y, z)) / j(x, y, z) + h(x, y, z) - m(x, y, z) - n(x, y, z)$
(3) $(g(x, y, z) - j(x, y, z)) / (f(x, y, z) - h(x, y, z))$
(4) $(h(x, y, z) - f(x, y, z)) / (n(x, y, z) - g(x, y, z))$

For Q.80 & Q.81 :

There are five machines A, B, C, D and E situated on a straight line at distances of 10 metres, 20 metres, 30 metres, 40 metres and 50 metres respectively from the origin of the line. A robot is stationed at the origin of the line. The robot serves the machines with raw material whenever a machine becomes idle. All the raw material is located at the origin. The robot is in an idle state at the origin at the beginning of a day. As soon as one or more machines become idle, they send messages to the robot-station and the robot starts and serves all the machines from which it received messages. If a message is received at the station while the robot is away from it, the robot takes notice of the message only when it returns to the station while moving, it serves the machines in the sequence in which they are encountered, and then returns to the origin. If any messages are pending at the station when it returns, it repeats the process again. Otherwise, it remains idle at the origin till the next message(s) is received.

80. Suppose on a certain day, machines A and D have sent the first two messages to the origin at the beginning of the first second, and C has sent a message at the beginning of the 5th second and B at the beginning of the 6th second, and E at the beginning of the 10th second. How much distance in metres has the robot travelled since the beginning of the day, when it notices the message of E? Assume that the speed of movement of the robot is 10 metres per second.

- (1) 140 (2) 80 (3) 340 (4) 360

81. Suppose there is a second station with raw material for the robot at the other extreme of the line which is 60 metres from the origin, that is, 10 metres from E. After finishing the services in a trip, the robot returns to the nearest station. If both stations are equidistant, it chooses the origin as the station to return to. Assuming that both stations receive the messages sent by the machines and that all the other data remains the same, what would be the answer to the above question?

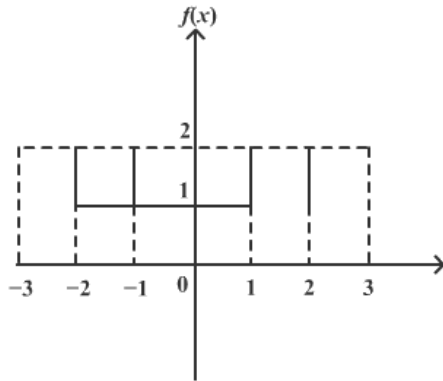
- (1) 120 (2) 140 (3) 340 (4) 70

For Q.82 to Q.84 :

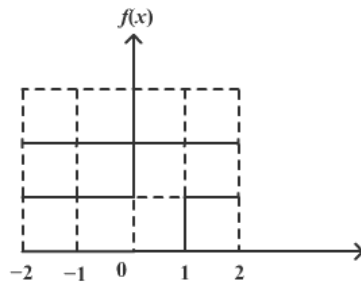
Given below are three graphs made up of straight-line segments shown as thick lines. In each case choose the answer as

- (1) if $f(x) = 3f(-x)$;
- (2) if $f(x) = -f(-x)$;
- (3) if $f(x) = f(-x)$; and
- (4) if $3f(x) = 6f(-x)$, for $x > 0$.

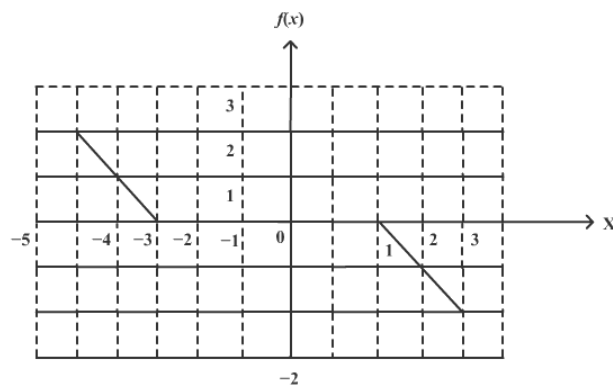
82.



83.



84.



For Q.85 & Q.86 :

There are three bottles of water, A, B, C, whose capacities are 5 litres, 3 litres, and 2 litres respectively. For transferring water from one bottle to another and to drain out the bottles, there exists a piping system. The flow through these pipes is computer controlled. The computer that controls the flow through these pipes can be fed with three types of instructions, as explained below

Instruction type	Explanation of the instruction
FILL (X, Y)	Fill bottle labelled X from the water in bottle labelled Y, where the remaining capacity of X is less than or equal to the amount of water in Y.
EMPTY (X, Y)	Empty out the water in bottle labelled X into bottle labelled Y, where the amount of water in X is less than or equal to remaining capacity of Y.
DRAIN (X)	Drain out all the water contained in bottle labelled X.

Initially, A is full with water, and B and C are empty.

85. After executing a sequence of three instructions, bottle A contains one litre of water. The first and the third of these instructions are shown below

First instruction FILL (C, A)

Third instruction FILL (C, A)

Then which of the following statements about the instructions is true?

- (1) The second instruction is FILL (B, A)
- (2) The second instruction is EMPTY (C, B)
- (3) The second instruction transfers water from B to C
- (4) The second instruction involves using the water in bottle A.

86. Consider the same sequence of three instructions and the same initial state mentioned above. Three more instructions are added at the end of the above sequence to have A contain 4 litres of water. In this total sequence of six instructions, the fourth one is DRAIN (A). This is the only DRAIN instruction in the entire sequence. At the end of the execution of the above sequence, how much water (in litres) is contained in C?

- (1) One
- (2) Two
- (3) Zero
- (4) None of these

For Q.87 & Q.88 :

For a real number x , let

$f(x) = 1/(1 + x)$, if x is non-negative

$= 1 + x$, if x is negative

$f^n(x) = f(f^{n-1}(x))$, $n = 2, 3, \dots$

87. What is the value of the product, $f(2)f^2(2)f^3(2)f^4(2)f^5(2)$?

- (1) $1/3$
- (2) 3
- (3) $1/18$
- (4) None of these

88. r is an integer ≥ 2 . Then, what is the value of $f^{r-1}(-r) + f^r(-r) + f^{r+1}(-r)$?

- (1) -1
- (2) 0
- (3) 1
- (4) None of these

