Common Admission Test

Crack CAT 3

SECTION I

This section contains 25 questions

Directions (Q. 1 and 2) : *Answer the questions independently of each other.*

1. Find the remainder when $11^1 \times 11^{11} \times 11^{111} \times \ldots \times 11^k$ is divided by 7; where k is a 1111 digit number, containing no other digit except 1.

(1) 1 (2) 4 (3) 5 (4) 2
(5) 3

2. At most how many regular convex polygons can be formed whose every interior angle is measured in integers?
Where sum of all the interior angles of an n-sided polygon is $(n-2)\,180°$ and sum of all the exterior angles of any polygon is always 360°. Also sum of any interior angle and the exterior angle of a regular polygon is always 180°.

(1) 18 (2) 10 (3) 16 (4) 22
(5) 36

Directions (Q. 3-5) : *Answer the questions on the basis of the information given below.*

Three ports *A, B* and *C* are located in different time zones. *B* is located 360 nautical miles north of *A* and *C* is located 180 nautical miles north of *B*. The table below describes the schedule of a steamer boat ferrying between *A* and *C* via *B*. All the times indicated in the table are local on the same day. The boat operates non-stop except haulting at *A, B* and *C*. These ports are situated along a river on the same bank, which is straight and the current of water flows from north to south at 30 nautical miles per hour.

Departure		Arrival	
City	**Time**	**City**	**Time**
A	6 : 00 am	*B*	10 : 00 am
B	11 : 30 am	*C*	1 : 30 pm
C	3 : 00 pm	*B*	3 : 30 pm
B	5 : 00 pm	*A*	6 : 00 pm

3. What is the time difference between *B* and *C*?

(1) 30 min (2) 1 h (3) 1 h 30 min (4) 2 h
(5) Can't be determined

4. What is the time difference between A and C?
(1) 30 min (2) 1 h (3) 1 h 30 min (4) 2 h 30 min
(5) None of these

5. What's the boat's normal cruising speed in nautical miles per hour?
(1) 90 (2) 120 (3) 150 (4) 240
(5) None of these

Directions (Q. 6-18) : *Answer the questions independently of each other.*

6. In an acute angled triangle ABC, the interior bisector of angle A meets BC at L and meets the circumcircle of ABC again at N. From L perpendicular drawn to AB and AC with feet K and M respectively. The ratio of areas of quadrilateral $AKNM$ and the area of triangle ABC is r, find the value of r.
(1) $r < 1$ (2) $r = 1$ (3) $r > 1$ (4) Can't be determined
(5) None of these

7. Consider the concentric circles with radii R and r, $(R > r)$, on the same plane. Let C be a point on the smaller circle and D be a point on the larger circle. The line CD meets the larger circle again at A. The perpendicular l to the CD at C meets the smaller circle again at E. If l is tangent to the circle at C, then $C = E$. Find the value of $AD^2 + DE^2 + EA^2$.
(1) $3(2r^2 + 3R^2)$ (2) $6R^2 + 2r^2$ (3) $2r^2 + 3R^2$ (4) $\sqrt{3r^2 + 4R^2}$
(5) None of these

8. Virgin mobiles; a communication arm of the virgin group, headed by Sir Richard Branson—offers variety of recharge coupons worth $1 \le r \le n$ (in Rs). Besides these coupons are offered in different packs. A pack contains 'r' recharge coupons with different denominations. A set of all such packs (P_r), which contain non-identical packs (P_r), is called super packs (SP_r). Any two non-identical packs (P_r) contain at least one different recharge coupon. Consider a super pack (SP_r) in which all packs (P_r) has smallest value recharge coupon. Let $F(n, r)$ denote the arithmetic mean of these smallest recharge coupons, the $F(n, r)$ is equal to
(1) $n - (r + 1)$ (2) $\dfrac{n+1}{r+1}$ (3) $\left(\dfrac{nr+1}{2}\right)$ (4) $\dfrac{n!}{r!}$
(5) None of these

9. For every $0 \le x \le 1, 0 \le y \le 1$ and $0 \le z \le 1$, the maximum values of the two expressions
(i) $x^2y - y^2x$ and (ii) $x^2y + y^2z + z^2x - x^2z - y^2x - z^2y$
will be
(1) 3/4; 3 (2) 0; 1/4 (3) 1/9; 0 (4) 1/4; 0
(5) None of these

10. Tanishq has 361 rings of gold. He sells some of them at a loss of 4% and rest at a profit of 15% making overall profit of 8%. Find the number of rings sold at a profit of 15%.
(1) 171 (2) 133 (3) 218 (4) 228
(5) None of these

11. $ABCD$ is a square shaped field with area $400\,m^2$. A is joined to a point P on BC and D is joined to a point Q on AB, where AP and DQ being equal in length intersect each other at a point R. One goat is tied up at P and another goat is tied up at Q, each with equal length of strings such that they can just touch each other. What is the smallest possible length of string required for each goat?
(1) $4\sqrt{3}$ m (2) $5\sqrt{2}$ m (3) $10\sqrt{2}$ m (4) $\dfrac{10}{\sqrt{3}}$ m
(5) None of these

12. A stockist wants to make some profit by selling sugar. He contemplates about various methods. Which of the following would maximise his profit?
I. Sell sugar at 10% profit.
II. Use 900 g of weight instead of 1 kg.

III. Mix 10% impurities in sugar and selling sugar at cost price.
IV. Increase the price by 5% and reduce weights by 5%.
(1) I or II (2) II (3) II, III and IV (4) Profits are same
(5) None of these

13. Only a single rail track exists between stations A and B on a railway line. One hour after the north bound superfast train N leaves station A for station B, a south bound passenger train S reaches station A from station B. The speed of the superfast train is twice that of a normal express train E, while the speed of a passenger train S is half that of E. On a particular day, N leaves for station B from station A, twenty minutes behind the normal schedule. In order to maintain the schedule, both N and S increased their speeds. If the superfast train doubles its speed, what should be the ratio (approximately) of the speed of passenger train to that of the superfast train so that passenger train S reaches exactly at the scheduled time at station A on that day
(1) 1 : 3 (2) 1 : 4 (3) 1 : 5 (4) 1 : 6
(5) 2 : 5

14. Each of the members $x_1, x_2, \ldots, x_n$, $n \geq 4$, is equal to 1 or -1. Suppose $x_1x_2x_3x_4 + x_2x_3x_4x_5 + x_3x_4x_5x_6 + \ldots + x_{n-3}x_{n-2}x_{n-1}\ x_n + x_{n-2}x_{n-1}x_nx_1 + x_{n-1}x_nx_1x_2 + x_nx_1x_2x_3 = 0$, then
(1) n is even (2) n is odd
(3) n is an odd multiple of 3 (4) n is prime
(5) None of these

15. Along a road lie an odd number of stones placed at an intervals of 10 m. These stones have to be assembled around the middle stone. A person can carry only one stone at a time. A man carried out the job starting with the stone in the middle, carrying stones in succession, thereby covering a distance of 4.8 km. Then, the number of stones is
(1) 35 (2) 15 (3) 29 (4) 31
(5) 36

16. I am deliberating to have a quirky resolution for the year 2009. According to my resolution, each day either I will go to casino with Games Fond or I will go on a long drive with my girl friend Hipso Seksy, starting from the first day of the year until the last day of the same year. Let p be the natural number relatively prime to 366 and $p < 366$. It is given that
(a) for each i, both i_{th} *and* f_{th} day I will do the same thing; when $f = (366 - i)$,
(b) for each $i \neq p$, both i_{th} day and g_{th} day, I will do the same thing, where $g = |i - p|$
Which of the following can be said to be always true about my resolution?
(i) Every alternate day I will be dating my girl friend.
(ii) Throughout the year I will go to casino only.
(iii) Throughout the year, I will go on the long drive with my girl friend.
(iv)I will utilize more number of days on long drive than that of going to casino, but I will go to casino at least 73 days.
(v) I will go to casino only 73 days and on the rest days I will be on long drive with my girl friend.
(1) Only (i) and (iv) are true (2) Only (ii) is true
(3) Only (iv) is true (4) Either (ii) or (iii) is true
(5) Either (iv) or (v) is true

17. Let m be any natural number not equal to 2, 5 or 13. Consider distinct a, b in the set $\{2, 5, 13, m\}$. Let $x = 2m - 1$, $y = 5m - 1$, $z = 13m - 1$. How many values of m are there such that all of x, y and z are simultaneously perfect squares?
(1) 0 (2) 1 (3) 3 (4) 8
(5) 20

18. In a circus, there are n clowns who dress and paint themselves up using a selection of twelve distinct colours. Each clown is required to use at least five different colours. One day, the ring-master of the circus orders that no two clowns have exactly the same set of colours and no more than twenty clowns may use any one particular colour. Find the largest number n of clowns so as to make the ring-master's order possible.
(1) 48 (2) 18 (3) 54 (4) 36
(5) None of these

Directions (Q. 19 and 20) : *Answer the questions based on the information given below.*

Counterfeit coins weigh a and genuine coins weigh $b (a \neq b)$. You are given two samples of three coins each and you know that each sample has exactly one counterfeit coin. The minimum number of weighings are required to be certain of isolating the two counterfeit coins by means of an accurate scale (not a balance).

19. Find the minimum number of weighings required when a and b are known.
(1) 4 (2) 2 (3) 6 (4) 3
(5) None of these

20. Find the minimum number of weighings required when a and b are unknown.
(1) 2 (2) 6 (3) 4 (4) 5
(5) Can't be determined

Directions (Q. 21-25) : *Answer the questions independently of each other.*

21. Consider the following operation on positive real numbers written on a blackboard : Choose a number r written on the blackboard, erase that number, and then write a pair of positive real numbers a and b satisfying the condition $2r^2 = ab$ on the board.
Assume that you start out with just one positive real number, not necessarily distinct.
There exists a number s on the board such that
(1) $s < kr$ (2) $s \leq kr$ (3) $s > k$ (4) $s \geq kr$
(5) None of these

22. p is an integer for which there are rational numbers a and b such that the polynomial $x^5 - px - 1$ has at least one root in common with the polynomial $x^2 - ax - b$. Which of the following can't be the possible value of p?
(1) -1 (2) 0 (3) 2 (4) 3
(5) None of these

23. In how many ways can the letters of the word REPEAT be arranged?
(1) 2240 (2) 360 (3) 232230 (4) 420
(5) 720

24. What will be the 33rd term of the sequence 1, 7, 25, 79, ...?
(1) $33^3 - 1$ (2) $3^{33} - 2$ (3) $3(33^3 - 2)$ (4) $(3^{32} - 2)$
(5) None of these

25. A shopkeeper calculated his profit per cent on the selling price which comes out to be 30%. If it had been calculated as usual on the cost price, then what is the required percentage profit?
(1) $42\frac{6}{7}\%$ (2) $4\frac{2}{27}\%$ (3) $7\frac{6}{42}\%$ (4) 10%
(5) None of these

SECTION II

This section contains 25 questions

Directions (Q. 26-29) : *Answer the questions based on the information given below.*

Life Now an upcoming adult TV channel; recently started telecasting, its initial four programmes, Sexciting, Nite Bite, Sextempore and Sexcursion, all are intended to enhance adult education, strengthen relationships, create awareness about sexual health, mind and spirit. All these programmes are being telecast only on week days (except Saturday and Sunday) from 11 pm to 6 am.
Sexciting is a flagship program of Life Now, which gets telecast every night—Monday to Friday.
Life Now telecasts Nite Bite either on Tuesday morning and Friday morning from 1 am to 3 am or on Wednesday, Thursday, Saturday morning from 2 : 30 am to 4 am.
It telecasts Sextempore on Wednesday, Thursday and Saturday from 12 am to 2 am or on Tuesday and Friday from 2 am to 5 am.

It telecasts Sexcursion with a greater flexibility in timings only once in a week for one four-hour show or twice in a week each for two hours show.
It telecasts Sexciting except weekends (Saturday and Sunday) from 11 pm to 1 am or 4 am to 6 am.

26. What is the maximum number of two hour Sexcursion shows that are available to get telecast?
(1) 1 (2) 2 (3) 3 (4) 4
(5) 5

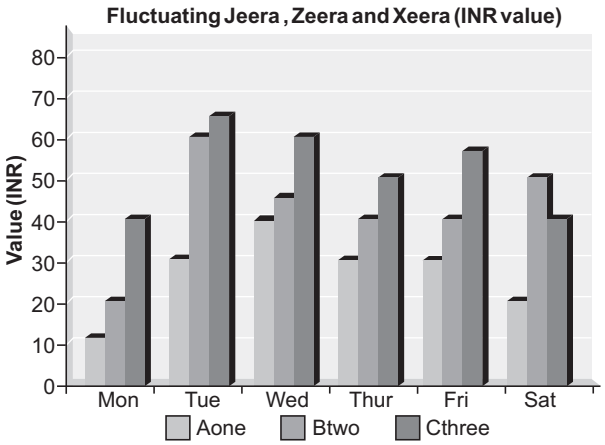
27. Life Now telecasts a four hour show of Sexcursion. If it wants to telecast another show-Sexpedition, then on which day (or night) can it telecast this programme once in a week?
(1) Monday-Tuesday (2) Tuesday-Wednesday (3) Wednesday-Thursday (4) Thursday-Friday
(5) Either (1) or (4)

28. If any show is getting telecast between 11 pm to 3 am it is called night show, and if any show is getting telecast between 3 am to 6 am it is called morning show.
Which of the following is impossible to telecast on the same cusp of night (*ie,* the intervening night of Monday-Tuesday or Tuesday-Wednesday etc)?
(1) Sexciting in the night and Sexcursion in the morning.
(2) Sexciting in the morning and Sexcursion in the night.
(3) Sextempore in the night and Sexciting in the morning.
(4) Sexciting in the night and Nite Bite in the morning.
(5) Nite Bite and Sexcursion both in the night.

29. If Sexcursion is to be shown for 2 hours on Wednesday morning. Which of the following programmes can be shown?
(1) Nite Bite on Wednesday, Thursday, and Saturday at 2 : 30 am to 4 am.
(2) Sextempore on Wednesday, Thursday, Saturday at 12 am to 2 am.
(3) Sexciting on all the five nights at 11 pm to 1 am.
(4) (1), (2) and (3)
(5) Either (1) and (3) or (2) and (3)

Directions (Q. 30-32) : *Answer the questions on the basis of the information given below.*

Due to uncertainties regarding new government's formation, at the heart of India, in Delhi, there has been observed a considerable fluctuation in the values of Jeera, Zeera and Xeera, three currencies from Jamaika, Zeopardesh and Xtraterritory. The observation in fluctuation is captured and depicted below in the bar graphs, disguised as Aone, Btwo and Cthree non-necessarily in the same order. Their values across Monday to Saturday are given in INR (Indian Rupees, as shown in the bar graph).



30. Converting a currency *Y* into another currency *Z* or *vice-versa*, is called a transaction. What is the maximum amount (in INR) you can earn by at most ten transactions over Monday to Saturday. If you have 10,000 INR to start with on Monday.
(1) 51875 (2) 40000 (3) 40875 (4) 30000
(5) None of these

31. Mr. Raju, the CFO of a Truely Lier corporation, converted 10000 INR into Zeera on Monday, in his own individual capacity for personal interest. Converted back into INR on Wednesday. Next day he converted all the INR currency into Zeera again, held till Friday, on Friday he converted all the Zeera into Jeera through INR. How many Jeeras he possibly have got?
(1) 1080 (2) 1000 (3) 1100 (4) 940
(5) 506

32. If exchange-rate of currency X to currency Y be equal to INR equivalent of X divided by INR equivalent of Y, and if the exchange-rate of Xeera to Jeera is 4/3 on one of these days, all of the following could be true EXCEPT
(1) exchange-rate of Xeera to Zeera on Saturday is 2.5.
(2) exchange-rate of Xeera to Zeera on Wednesday is 1.5.
(3) exchange-rate of Jeera to Zeera on Monday is 2.
(4) exchange-rate of Zeera to Xeera on Saturday is 1.
(5) exchange-rate of Xeera to Jeera on Tuesday is 1.

Directions (Q. 33 and 34) : *Answer the questions on the basis of the information given below.*

Seven passengers boarded a train at Kalyan Junction in Mumbai. The passengers $P_1, P_2, \ldots, P_7$ were supposed to be seated on the berth number 101, 102, …, 107, but not necessarily in the same order.
Due to some mistake, all of them did not sit on the right berth, however no two passengers sat on the exchanged seat numbers. (That means A did not sit on B's seat and vice versa).

- P_4 sat on berth number 105 and P_2 sat on 107. Hence both got the wrong seats independently.
- P_5 got 106 while P_6 got 103 and the passenger who should have got 105 did not get 101 or 106.
- P_3 sat on 102 while he was supposed to sit on 101 and P_7 sat on the right birth number.

33. If at most two passengers sat on the alloted (or right) berth (number), then the passenger who was supposed to sit on berth number 106, got which berth number finally?
(1) 107 (2) 104 (3) 102 (4) 101
(5) 103

34. If P_7 was not supposed to get berth number 102, then what was the berth number on which the passenger sat who was supposed to be seated on berth number 102?
(1) 105 (2) 103 (3) 101 (4) Can't be determined
(5) None of these

Directions (Q. 35-38) : *Answer the questions based on the following information.*

The table below gives the number of students in 10th standard in different years and their marks in Science in the annual exams.

Year	No. of Students	Marks in Science			
		Lowest	Average	Highest	Max. Marks
2001	48	22	66	98	100
2002	50	30	70	110	120
2003	45	31	73	112	120
2004	60	25	80	120	125
2005	70	32	110	140	150
2006	60	18	88	96	100
2007	50	06	32	46	50
2008	80	11	35	48	50

35. In which year was the sum of marks obtained by the students in the class maximum?
(1) 2006 (2) 2005 (3) 2004 (4) 2007
(5) Data insufficient

36. In which year were the lowest marks the highest as a percentage of maximum marks?
(1) 2001 (2) 2002 (3) 2003 (4) 2004
(5) None of these

37. In how many years were the lowest marks less than 25% of the maximum marks?
(1) 1 (2) 2 (3) 3 (4) 6
(5) 4

38. In which year the average marks was the highest in terms of percentage of maximum marks?
(1) 2006 (2) 2005 (3) 2008 (4) 2003
(5) Can't be determined

Directions (Q. 39-42) : *Answer the questions on the basis of information given below.*

At my coaching institute I have 35 IIM graduates to teach various subjects; QA, DI, LR and VA, only. These IIM graduates are from IIM A, IIM B, IIM C and IIM L only. They are the only ones to teach the given four subjects.
The graduates from IIM C who teach DI is 2.
From each of the IIMs; A, B, C and L; not less than one and not more than four graduates are hired.
The number of graduates from each of IIM A, IIM C, and IIM L is twice the number of graduates from IIM B.
The total number of IIM graduates hired for DI is same as the total number of IIM graduates hired for VA, which in turn is thrice the total number of IIM graduates hired for LR.
If there had been 3 less quant faculty (*ie*, IIM graduates), the total number of quants faculty would have been same as the total number of faculty members for LR.

39. If two IIM graduates are hired from IIM L, which of the following is NOT correct?
(1) Four VA faculty members are hired from IIM A.
(2) Four VA faculty members are hired from IIM L.
(3) Three QA faculty members are hired from IIM C.
(4) Four VA faculty members are hired from IIM C.
(5) One QA faculty member is hired from IIM A.

40. Which of the following combinations of hired faculty is NOT possible?
(1) The number of QA faculty hired from each of IIM A and IIM L is one.
(2) The number of QA faculty hired from IIM C and IIM L are three and one respectively.
(3) The number of VA faculty hired from each of IIM A and IIM C is four.
(4) Three QA faculty members are from IIM C and four VA faculty members are from IIM A.
(5) Three VA faculty members are from IIM A and four QA faculty members are from IIM C.

41. From the given information regarding hired graduates from IIMs, which of the following can't be determined?
(1) Number of DI faculty from IIM B. (2) Number of QA faculty from IIM B.
(3) Number of VA faculty from IIM L. (4) Number of DI faculty from IIM A.
(5) Number of LR faculty from IIM C.

42. What can be inferred about the number of QA faculty members from IIM A?
(1) It's not less than one not more than two. (2) It's not less than two not more than four.
(3) It's not less than one not more than three. (4) It's not less than two not more than three.
(5) It's not less than three not more than four.

Directions (Q. 43-46) : *Answer the questions on the basis of information given below.*

The following table gives details of the mobiles (or cell phones) carried by employees in an office. Every employee must have at least one cell phone and only these four cell phone brands – Nokia, Samsung, Blackberry and Motorola are available there with them.

Brand	No. of Employees who have only	No. of Male Employees who have	No. of Female Employees who have
Nokia	10	50	40
Samsung	15	40	45
Blackberry	05	30	25
Motorola	70	60	50

43. What is the maximum possible number of employees who have all the four cell phone brands?
(1) 40 (2) 50 (3) 05 (4) 30
(5) 15

44. What is the maximum possible number of female employees who have exactly three cell phone brands?
(1) 12 (2) 6 (3) 50 (4) 15
(5) 05

45. What is the minimum possible number of male employees in the office?
(1) 45 (2) 48 (3) 84 (4) 17
(5) 70

46. What is the maximum possible number of employees in the office?
(1) 120 (2) 110 (3) 250 (4) 220
(5) 320

Directions (Q. 47-50) : *Answer the questions on the basis of the information given below.*

Ajay, Boby, Chandra, Deepak, Esha, Farooq, Gautam study in the same coaching but four different subjects : Maths, Physics, Chemistry, Stats. They belong to three different schools : Akadami, Bidya Mandir, College Korner. The following information is also known.

1. Boby and Deepak are from same school.
2. Ajay does not study Maths, Boby does not study Chemistry. Deepak study Physics.
3. At least one of Esha and Gautam study either Physics or Stats. Ajay belongs to Bidya Mandir, Esha belongs to College Korner and Farooq belongs to Akadami.
4. At least two students belong to each school. All those who belong to Akadami study Physics and no student who belong to Bidya Mandir study Chemistry.
5. Number of students studying Physics is one more than those studying Statistics (*ie*, Stats).
6. No two of Ajay, Boby, Chandra and Deepak study the same subject.
7. No three subjects are studied by the same number of students.

47. How many students are from Akadami?
(1) 2 (2) 3 (3) 4 (4) 1
(5) 0

48. Esha studies
(1) Maths (2) Physics (3) Chemistry (4) Stats
(5) None of these

49. Which two subjects are studied by the same number of students?
(1) Maths and Chemistry (2) Physics and Chemistry
(3) Stats and Maths (4) Physics and Maths
(5) Chemistry and Stats

50. Gautam belongs to which school?
(1) Akadami (2) Bidya Mandir
(3) College Korner (4) Can't be determined uniquely
(5) None of these

SECTION III

This section contains 25 questions

Directions (Q. 51-55) : *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 five given choices to construct a coherent paragraph.*

51. A. But by the 1970s it was felt that all was not well with this 'acceptable face of capitalism', with its generous welfare state.
B. It was inflationary, inefficient, complacent, and punitive to enterprise and wealth creation.
C. Hence many of the state interventionist policies instituted during the Thatcher/Reagon years were specifically designed to unfetter market forces (especially the free global flow of capital) and to make the economic world approximate more closely again to the ideas of the first great worldly philosopher, Adam Smith.

D. In the 1980s there was a growing body of opinion that capitalism's viability depended on 'being kinder to capital at the expense of labour'.
E. In the 1930s and again in the 50s and 60s, Keynesian orthodoxy promoted a policy, broadly, of 'being kinder to labour at the expense of capital', because it was felt that this was the only way for capitalism to survive in the face of communist and fascist alternatives.

(1) ABDEC (2) DACEB (3) ECABD (4) EABDC
(5) DABCE

52. A. To succeed consistently, good managers need to be skilled not just in assessing people but also in assessing the abilities and disabilities of their organization as a whole.
B. That's because organizations themselves– independent of the people and other resources in them–have capabilities.
C. Often that is not the case. One could put two sets of identically capable people to work in different organizations, and what they accomplished would be significantly different.
D. But unfortunately, most managers assume that if each person working on a project is well matched to the job, then the organization in which they work will be, too.
E. One of the hallmarks of a great manager is the ability to identify the right person for the right job and to train employees to succeed at the jobs they're given.

(1) EDBAC (2) EDCBA (3) ABDEC (4) ABEDC
(5) AEDBC

53. A. The mountains are the occasion for Esther's first blush with spirit felt but not understood in hymns and prayers of the Jewish refugees.
B. And yet it is not a religion of tomes and dogma, for Esther cannot understand the language of the prayers but one of rhythm, heart and desire, a search and a yearning.
C. Neither encouraged nor forbade by her atheist father and mother, religion, begins as curiosity for the young exile and then an almost physical need as she becomes drawn over and over to its call.
D. Le Clezio returns to its over and again, sometime numbingly so, as the mother and daughter pair, arrive first in Italy, then France and then across an ocean and into a Zion torn from the flesh of long suffering people.

(1) DABC (2) ACDB (3) ACBD (4) ABCD
(5) DBAC

54. A. Every year there would be a Global Festival of Gratitude and Giving, during which gifts would be freely exchanged and art, music, dances and games would celebrate and renew the freedom of the Earth from human domination.
B. Communal products could be exchanged freely amongst individuals or between societies. There would be no money, and no hoarding of mutually-owned resources, on pain of banishment to the wilderness.
C. Whilst each society would decide its own rules, the Confederation would respect a universal constitution according to which no-one can own anything they have not made.

(1) ABC (2) ACB (3) BAC (4) BCA
(5) CBA

55. A. These are scary times for managers in big companies.
B. Medical and business schools are struggling–and failing–to change their curricula fast enough to train the types of doctors and managers their markets need.
C. Even before the internet and globalization, their track record for dealing with major, disruptive change was not good.
D. Not one of the minicomputer companies succeeded in the personal computer business.
E. Out of hundreds of department stores, for example, only one–Dayton Hudson–became a leader in discount retailing.
F. The list could go on.

(1) ABCDEF (2) ACDBEF (3) EFDEBC (4) ACEDBF
(5) EDACBF

Directions (Q. 56-58) : *For each of the words below, contextual usage is provided. Choose the word from the alternatives given that is most appropriate in the given context.*

56. Conundrum : The resulling conundrum has made it difficult to determine the best treatment regimen for patients.
(1) malestrom (2) unanimity (3) dilemma (4) harmony
(5) boon

57. Feckless : Feckless people like Willium and his wife, standing helplessly in different parts of the room, made her impatient.
(1) impulsive (2) supercilious
(3) ineffectual (4) disreputable
(5) irreprehensible

58. Rubicund : From his rubicund cheeks and warm smile, he looked as if he regularly enjoyed a good bottle of wine and the company of amusing people.
(1) supple (2) tant (3) ruddy (4) rotund
(5) radiant

Directions (Q. 59 and 60) : *Each of the following questions has a paragraph from which one sentence has been deliberately removed. From the given options, choose the one that completes the paragraph in the most appropriate way.*

59. The best thing for children is for them to be given more freedom-not to do whatever they want, of course; they need clear boundaries set by parents. But unsupervised play is not just some kind of childhood luxury that kids can do without. It is vital for children's healthy emotional and social development. Study after study has shown that it helps to develop children's ability to negotiate social rules and to create their own rules. Children need to learn to deal with risks and develop the capacity to assess challenges and develop resilience to life's inevitable blows. ……
(1) In short, taking risks in childhood is necessary for children's intellectual development.
(2) In short, taking risks in childhood is necessary for children's physical development.
(3) In short, taking risks in childhood goes hand-in-hand with developing new skills.
(4) In short, taking risks in childhood can have unexpected consequences.
(5) In short, taking risks in childhood should not be discouraged.

60. Increasingly, India's elderly feel vulnerable, lonely or abandoned. They may have lost a spouse or had children more overseas, or in cases of abuses, been turned out of homes they helped create. The children now find themselves sandwiched between looking after their own family and caring for old parents. …… . What they are short of is time and attention and the elderly have taken notice?
(1) Urban professionals who have grown up in nuclear families find it more difficult to adjust themselves.
(2) Urban professionals find it difficult to acclimatize themselves to such a demanding scenario.
(3) Urban professionals may not have adequate money and time to look after their parents.
(4) Urban professionals may have more money to buy their parents better healthcare.
(5) Urban professionals must now decide how to care for those who looked after them.

Direction (Q. 61) : *The sentence given below has one or more blank spaces; each blank indicating that a word has been omitted. Beneath the sentences are four numbered words or set of words. You are to choose the one word or set of words which, when inserted in the sentence, best fits in with the meaning of the sentences as a whole.*

61. What is …… at the …… moment is the nature of the security debate and the manner in which a dominant narrative has emerged?
(1) pertinent …… relevant (2) germane …… current
(3) extrinsic …… suitable (4) indicated …… extraneous
(5) imperative …… crucial

Directions (Q. 62-75) : *Refer to the passages and answer the questions that follow.*

PASSAGE 1

Jan Lindemann knows a thing or two about branding. He heads Brand Valuation, and puts together the Interbrand survey of the world's most powerful brands. So, his recent talk at a marketing summit in Delhi attracted a goodly audience. One slide made several people sit up. The combined value of the world's top 15 brands is more than India's gross domestic product!

Later, a group of colleagues got chatting with Lindemann and Ramesh J Thomas of Equitor. The talk turned to branding and national wealth. Why, asked one colleague, can't cumulative brand value be used to measure national wealth? After all, there are many accepted quality of life indicators, apart from just per capita GDP. There's infant mortality, literacy levels, telecom penetration etc. Why not use a brand index to reflect national prosperity?

Think about it. The presence of brands argues a certain level of social and economic development. Brands were not a feature in the agricultural First Wave, and only began to show up at an advanced stage of the industrial Second Wave. The advent of branding signals a certain sophistication of manufacturing processes, communication facilities and market forces. It indicates an economy's entry into what Rostow termed the age of high mass-consumption. The most developed economies are precisely the ones that create and nurture the most powerful brands. Branding, ultimately, stands for the creation of value in the consumer's mind. And what is wealth but value creation?

But would a brand index find ready acceptance with economists and government functionaries? After all, many 'serious' people still seem to regard practitioners of the noble discipline of branding as some kind of snake oil salesmen. Thomas said brand consciousness could be disseminated through the government, but must first permeate boardrooms. Too many CEOs still don't understand brand evaluation. It's only during M & A time that they take brand value seriously. But the concept of brand value as a factor which should guide, say, investment decisions has yet to catch on.

That brought forth the next question. Why shouldn't brand value be measured daily, instead of being an annual exercise? Market capitalization is accepted as a valid measure of corporate health. Analysts track it daily, even hourly. Yet, what is market cap but the monetization of investor sentiment? If that can be accepted as a tangible, 'hard' measure, why not brand value?

Purists posit that you don't need daily measurement, because brand value changes very slowly. Uh-oh. A human being may live a long time, and remain reasonably healthy throughout. But would the state of his health be the same every day? Obviously not. It would vary, depending on a multitude of factors, both external and internal. The body provides constant feedback. This can be expressed in numbers, like body temperature or blood pressure. But even without seeing the figures, individual know, instinctively, when they are 'feeling like a million bucks' or when they are not quite '100 per cent'. The tendency, though, is to ignore minor niggles till one day they blow up into something big.

Some humans, however, are judged to be so important that their health becomes a matter of public concern. Thus, country CEOs—grandly titled heads of state—have physicians constantly monitoring their well-being. That's the role a brand manager should be playing. Every day, he should be analysing how macro-economic, social, political, market and internal corporate developments–to name few–have affected the brand's value. When the corporate leadership discusses plans, he should be the one instantly assessing the potential impact on brand value.

He should not be so much a brand manager as a brand value manager.

How can one assess brand value daily? The purely quantitative way would be to list every single factor affecting brand value. Then track each factor and calculate its impact on brand value. But such an exercise would soon deteriorate into mere number crunching if not accompanied by a holistic appreciation of the brand. Perhaps the only way to achieve such a perspective is to practice brand management by embodiment.

There's an old Zen saying to the effect that the great archer does not try to hit the target, he simply seeks to become the perfect arrow. That is the path for those aspiring to 'brandom'. When one is constantly thinking about something, it eventually generates a level of oneness with the object of obsession. A truly great brand manager takes on the persona of the brand. He no longer manages the brand, he is the brand. This level of

self-immersion is difficult to reach. But once it is achieved, everything else falls naturally into place. That's when the brand truly takes on a life of its own.

The CEO, though, has his own dharma. He must see himself as a trader with a portfolio of brands. He must rise above misplaced sentiment, and be constantly on the look-out for deals, buying high-value brands, selling poor performers. Ingesting strong brands nourishes corporates, excreting weak ones cleanses the system. The human body follows a natural rhythm, and so should corporates. Think of it as the healthy way to wealth.

62. All of the following issues are covered in the passage except
(1) brand value is affected every single day by a multitude of factors.
(2) a good marketer must not just manage the brand, s/he must be the brand.
(3) CEOs should see themselves as brand traders and constantly seek good deals.
(4) it is impossible to use cumulative brand value to measure national wealth as a lot of variable factors are involved in such a measurement.
(5) Both (1) and (2)

63. In what way does the author advocate improvement and enhancement of brand value?
(1) S/he advocates the principle of excellence by embodiment.
(2) By ensuring healthy competition amongst brands which according to him/her is a healthy way of creating more wealth.
(3) By engendering a holistic appreciation of brand value instead of daily number crunching.
(4) By living the brand.
(5) All of the above

64. The author uses the analogy of human health index to prove that
(1) human health cannot be in any way used as a marker for measuring brand value.
(2) brand value is not static unlike human health.
(3) brand value varies from time-to-time just as human health does.
(4) Both (1) and (2) above
(5) Both (2) and (3) above

65. If brand index were to reflect national prosperity
(1) it would improve the social and economic health of the country.
(2) it would herald a certain sophistication of manufacturing processes, communication facilities and market forces.
(3) it would lead the country into the next stage of mass-consumption.
(4) It would bring the sustainable growth of the country.
(5) None of the above

66. How would you classify this passage?
(1) Analytical (2) Argumentative (3) Factual (4) Abstruse
(5) Provocative

67. The statement that cumulative brand value be used to measure national wealth suggests
(1) a distinct possibility in the context of this passage.
(2) a failure of other methods of measuring national wealth accurately.
(3) a burning need of the industry to survey and account for the world's most powerful brands.
(4) a future possibility once the niggling doubts of the unbelievers are accounted for.
(5) a substitute to Gross Domestic Product (or GDP).

68. "The great archer does not try to hit the target, he simply seeks to become the perfect arrow." This statement is used to show that
(1) until one becomes obsessed with what one is doing, there will be no results.
(2) the success of a brand largely depends on the image of the person projecting that particular brand.
(3) in order to achieve success, it is important to be one with the objective one is aspiring towards.
(4) the brand image is only a means to an end, success depends on how the image is finally received by the public.
(5) there should be no difference between the espoused image and the perceived image of the brand.

PASSAGE 2

The story is all too familiar : A team that's been batting a thousand suddenly strikes out. Consider the hypothetical case of Cereal Co. The company secures a foothold in the breakfast foods niche with a plain but profitable line of low sugar products and a commitment to continuous improvement. Now, senior executives want to duplicate their success in snack foods. Realizing that Cereal Co lacks the marketing muscle to squeeze a copycat product into the crowded snack food market, senior management reassembles the cross-functional product development team responsible for its previous brand-extension initiatives. The task : Innovate. Devise a unique snack food that will seize market share by sheer distinctiveness and appeal.

The development team is made up of experts from marketing, market research, manufacturing, product development, sales, purchasing and finance, all of whom have worked well together before and have formed close relationships. Once senior managers brings the team together, they consciously and conspicuously back off; allowing the group to get to work.

Six months later, beset by false starts and dead ends, the team has little to show for its efforts. The development methods that had proved so effective in cereal brand extensions aren't working. Frustrated by the group's failure to break new ground, management decides to pull the plug and start from scratch. What went wrong?

Our recent study of what makes cross functional teams innovate well suggests some answers. We surveyed 141 project managers who had led major new-product initiatives in a diverse array of consumer products industries. What we found challenges some closely held notions about the roots of creative teamwork.

Many managers, for instance, believe that cross-functional diversity provides the variety of perspectives and ideas essential to creative thinking. But we found that merely including people from a large number of functional areas on a team doesn't improve its innovativeness. In fact, we saw no significant differences in innovativeness between teams with as few as two functional areas represented and those with as many as 11. While more ideas may come to the table as diversity increases, team problem solving gets harder. Information overload can bog down the process, cancelling out the benefit of having more perspectives and ideas to work with.

Another reason that high functional diversity increased innovativeness is that team members often hold deep-rooted functional allegiances that can compromise their ability to identify with a new team. Having a strong 'superordinate identity' –a sense of belonging to the team and having a stake in its success –encourages team members to find novel connections among their diverse perspectives. And this is the grist for innovation.

The strength of interpersonal ties among team members also influences innovativeness –but not in the way that many managers think. Candid debate is critical to the process of innovation. Yet high social cohesion among team members can actually suppress the forthright exchange of opinions, highly cohesive groups focus more on maintaining relationships and thus, tend to seek concurrence. Our study found that as social ties among members of a cross-functional team intensify, the innovativeness of its new product diminishes.

We also found that management has an important role to play in promoting the innovation of teams. In our study, teams encouraged by management to be venturesome came up with the most innovative products. These teams were invited to deviate from routine problem solving approaches and pursue untried ideas in contrast to teams expected to embrace continuous improvement practices that build incrementally on established product development strategies.

Finally, our study challenged an article of faith about management oversight. Conventional wisdom promotes hands-off management, presuming that a team under the magnifying glass will be inhibited, but we found the opposite. Within limits, close monitoring by senior management signals to team members and the rest of the company that their project is important. This is a powerful motivator, enhancing the team's creativity. It also makes organizational resources more available to the team because it's hard not to cooperate with a team that is visibly on management's radar.

69. The illustration of the cereal company in the first part of the passage proves that

(1) it is important to challenge set notions of management techniques from time-to-time.

(2) diversity, cohesiveness and autonomy might seem critical to group innovation, but they don't always seem to work.

(3) innovation requires continual supervision and microscopic observation.
(4) teams that have proved successful once, do not necessarily deliver the goods next time given the same conditions.
(5) All of the above

70. Which of the following is not mentioned as a way of kindling innovation in a team?
(1) Diversity in the composition of the team
(2) Social cohesiveness
(3) Taking risks
(4) Autonomy in decision-making
(5) All of these

71. On the basis of the passage, what according to you, could the management of the CerealCo have done differently to get the innovative output it was after?
(1) Allowed the team to argue openly about their differences of opinion.
(2) Should have greater autonomy in risk taking and decision-making.
(3) Should have changed the composition of the team by adding unknown elements to it.
(4) Cut back on the number of functional areas that the team was expected to focus on.
(5) It looked back into its history.

72. The overall message of the passage seems to be
(1) Innovate or perish
(2) Don't put all your eggs into one basket
(3) Too many cooks spoil the broth
(4) Nothing ventured, nothing gained
(5) Too fast, too furious

73. A strong 'superordinate identity' in a team is indicative of
(1) a weak management
(2) its cross-functional components
(3) greater social cohesiveness
(4) strong team leadership
(5) autocratic management

74. The fact that managers need to challenge some dearly held assumptions about what makes for a creative team is
(1) absolutely true
(2) partially true
(3) completely false
(4) partially false
(5) Cannot be determined

75. The writer of this passage could be
(1) a journalist writing an article for a daily
(2) an economist
(3) a research scholar
(4) a marketing whiz kid
(5) a sales executive

Crack CAT 3
Answers with Explanations

SECTION I

1. (2) $\frac{11^1}{7} = 4$ (Remainder)

$\frac{11^2}{7} = 2$ (Remainder)

$\frac{11^3}{7} = 1$ (Remainder)

It shows that the cyclicity of $\frac{11^n}{7}$;

for every $n = 1, 2, 3, 4$ etc, is 3.

Again $\frac{11^1}{7} \Rightarrow$ 4 (Remainder)

$\frac{11^{11}}{7} \Rightarrow 2$ (Remainder)

$\frac{11^{111}}{7} \Rightarrow 1$ (Remainder)

It shows that $\frac{11^k}{7}$, for every $k = 1, 11, 111, 1111$, etc, has the cyclicity of 3.

$\therefore \quad \frac{11^1 \times 11^{11} \times 11^{111} \times \ldots 11_{\underbrace{1\ldots\ldots1}_{1111 \text{ digits}}}}{7}$

$= \frac{(4 \times 2 \times 1) \times (4 \times 2 \times 1) \times \ldots (4 \times 2 \times 1) \times 4}{7}$

$= \frac{8 \times 8 \times \ldots 8 \times 4}{7}$

$= \frac{1 \times 1 \times \ldots 1 \times 4}{7}$

$= \frac{4}{7}$

= 4 (Remainder)

Hence, choice (2) is correct.

2. (4) Since interior angle = 180 − exterior angle. Therefore, in order to interior angle be an integer the exterior angle must be integer. But, since exterior angle be integer only when 360 is divisible by n (number of sides in a polygon) as each exterior angle = $\frac{360}{n}$

So, $360 = 2^3 \times 3^2 \times 5^1$

$\therefore$ Number of factors of 360 = (3 + 1)(2 + 1)(1 + 1)

= 24

The factors of 360 = 1×360

2×180

3×120

……

……

18×20

20×18

……

……

120×3

180×2

360×1

But we know that a polygon must have atleast three sides, and it can't have any exterior angle equal to or greater than 180°.

Hence, only 22 values of n are possible.

ie, $n = 3, 4, 5, \ldots, 120$.

Solutions (Q. 3-5)

From the table it is clear that boat takes total four hours to go from B to C and return from C to B. However, the boat halts at C for $1\frac{1}{2}$ h, so the net time taken from B to C and C to B just for travelling is $2\frac{1}{2}$ h.

$\therefore \quad 2\frac{1}{2} = \frac{180}{x - 30} + \frac{180}{x + 30}$

Only choice (3) satisfies the above relation that is $x = 150$, where x is the normal speed of stream of water.

Distance between B and C = 180 miles.

Time required to reach C from B = 180/120 = $1\frac{1}{2}$ h.

But the table shows that it takes two hours (11 : 30 am-1 : 30 pm)

It means the time difference B and C is

$$2 - \left(1\frac{1}{2}\right) = \frac{1}{2} \text{ h}$$

Similarly, time required to reach B from $A = \frac{360}{120} = 3$ h

But the given table shows that it takes four hours. (6 : 00 am – 10 : 00 am)

It means time difference between A and B is 1 h.

$\therefore$ Time difference between A and $C = 1 + \frac{1}{2} = 1\frac{1}{2}$ h.

3. Choice (1)

4. Choice (3)

5. Choice (3)

6. (2) AKL and AML are congruent triangles as $\angle AKL = \angle AML = 90°$ and $\angle KAL = \angle MAL$ (AL is the angle bisector of $\angle BAC$). So, KM is perpendicular to AN and area $AKNM = \frac{KM \cdot AN}{2}$. Since, $AKLM$ is cyclic (two opposite right angles), so $\angle AKM = \angle ALM$ and hence

$$\frac{KM}{\sin BAC} = \frac{AM}{\sin AKM} = \frac{AM}{\sin ALM} = AL$$

ABL and ANC are similar, so $AB \cdot AC = AN \cdot AL$

Hence, area $ABC = \frac{1}{2} AB \cdot AC \sin BAC$

$$= \frac{1}{2} AN \cdot AL \sin BAC$$
$$= \frac{1}{2} AN \cdot KM$$
$$= \text{area } AKNM$$

Hence, choice (2) is correct.

7. (2) Let M be the mid point of AD. Let $CM = x$. Let AD meet the small circle again at Q. Let O be the centre of the circles. Since, angle $ECQ = 90°$, EQ is a diameter of the small circle, so its length is $2r$.

Hence, $EC^2 = 4r^2 - 4x^2$

$$DM^2 = R^2 - OM^2 = R^2 - (r^2 - x^2)$$

That is essentially all we need, because we now have

$$DE^2 + DA^2 + EA^2 = (EC^2 + (DM - x)^2) + (EC^2 + (DM + x)^2) + 4DM^2$$
$$= 2EC^2 + 6DM^2 + 2x^2$$
$$= 2(4r^2 - 4x^2) + 6(R^2 - r^2 + x^2) + 2x^2$$
$$= 6R^2 + 2r^2, \text{ which is independent of } x.$$

Hence, choice (2) is correct.

8. (2) Let k be the smallest element we want to evaluate $g(n, r)$

$\Sigma_{k=1 \text{ to } n-r+1} \, k^{n-k} C_{r-1}$. Consider the subsets with $r + 1$ elements taken from 1, 2, 3, …, $n + 1$. Suppose $k + 1$ is the second smallest element. Then, there are $k[{}^{(n-k)}C_{(r-1)}]$ possible subsets. So,

$$g(n, r) = {}^{(n+1)}C_{(r+1)}$$

Hence, $f(n, r) = {}^{(n+1)}C_{(r+1)} / {}^{n}C_r = \frac{n+1}{r+1}$

9. (4) (i) By AM-GM inequality, $x^2y - y^2x = xy(x - y)$

$$= x[y(x - y)] \le x[(y + x - y)/2]^2 = \frac{x^3}{4}$$

with equality iff $y = x - y$ or $y = x/2$

It is clear that for $x = 1$ and $y = x/2 = 1/2$

$$x^2y - y^2x = 1^3/4 = 1/4$$

Therefore, the maximum value is 1/4.

(ii) Let $f \equiv f(x, y, z)$ be the given expression. If $x = y$, $y = z$ and $z = x$, f is zero.

Also, f has degree 3. It follows that $f = A(x - y)(y - z)(z - x)$ for some constant A. Since, $f(1, -1, 0) = -2$, so

$$A \cdot 2 \cdot (-1) \cdot (-1) = -2 \text{ or } A = -1$$

Thus, $f = (y - x)(z - y)(x - z)$

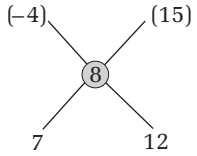
Since, f is symmetric in x, y and z, we can assume that $x \le y \le z$ without loss of generality. Now, $y - x, z - y \ge 0$ and $x - z \le 0$.

So, $f \le 0$. Also, $f(0, 0, 0) = 0$

Hence, the maximum value of f is 0.

Hence, choice (4) is correct.

10. (4) By alligation



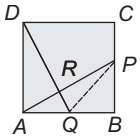
Now, we get the ratio of rings sold at a loss and profit is 7 : 12.

$\therefore$ Number of rings sold at a profit $= \frac{12}{19} \times 361$

$$= 228$$

Hence, choice (4) is correct.

11. (2) When P and Q will be the mid points of BC and AB respectively.



Then, $PQ^2 = BQ^2 + BP^2$

$\Rightarrow$ $PQ^2 = 10^2 + 10^2$

$\Rightarrow$ $PQ = 10\sqrt{2}$

$\therefore$ Required length of string for each goat $= 5\sqrt{2}$ m

If P and Q are not the mid points, then the required length of string will be more than this one.

Hence, choice (2) is correct.

Hint : $(a^2 + b^2)_{\max} = 2a^2$, when $a = b$ for $a + b$ = constant.

12. (2) I Profit = 10%

II Profit = 11.11% $\left(\frac{100}{900} \times 100 = \frac{100}{9}\%\right)$

III Profit = 10% $\left(\frac{100}{1000} \times 100 = 10\%\right)$

IV Profit = $\frac{200}{19}\%$ $\left(\frac{100}{95} \times 100 = \frac{200}{19}\%\right)$

Hence, choice (2) is correct.

13. (4) If speed of train $N = 4$ unit

Then, the speed of $S = 1$ unit

It implies that average speed $= \frac{2 \times 4 \times 1}{4 + 1} = 1.6$ unit

But available time $= \frac{2}{3}$, speed $= 3/2$

$\therefore$ Average speed = 2.4

Speed of $N = 8$

Speed of $S = x$

$\Rightarrow$ $\frac{2 \times 8 \times x}{8 + x} = 2.4$

$\Rightarrow$ $x = 1.3$

$\therefore$ Required ratio = 1.3 : 8 ≈ 1 : 6

Hence, choice (4) is correct.

14. (1) Each term has to be either 1 or –1.
Hence, if the sum of n such terms is 0, then n is even.
Hence, choice (1) is correct.

15. (4) Total distance travelled in both sides = 4.8 km
Total distance travelled in one side = 2.4 km
Man travels 20 m, 40 m, 60 m, … to bring one stone each time from different places.

$\therefore \quad 2400 = 20 + 40 + 60 + \ldots n\,(20)$

$\Rightarrow \quad 2400 = \frac{n}{2}[2 \times 20 + (n-1)\,20]$

$\Rightarrow \quad 2400 = 10n(n+1)$

$\Rightarrow \quad n = 15$ (Number of stones in each side)

$\therefore$ Total no. of stones = 15 + 1 + 15 = 31
Hence, choice (4) is correct.

16. (4) 366 and p are relatively prime, so $o, p, 2p, 3p, 4p, \ldots, 355p$ form a complete set of residues mod 366. So $p, 2p, \ldots, 365p$ are congruent to the numbers 1, 2, … , 365 in some order.
Suppose ip is congruent to r and $(i+1)p$ is congruent to s.
Then, either $s = r + p$ or $s = r + p - 366$.
If $s = r + p$, then we have immediately that $r = s - p$ and s have the same activity.
If $s = r + p - 366$, then $r = 366 - (p - s)$, so r has the same activity as $p - s$, and $p - s$ has the same activity as s. So, in any case r and s have the same activity. By giving i values from 1 to 364 this establishes that all the numbers have the same activity.
Hence, choice (4) is correct.

17. (1) Suppose $2m-1, 5m-1$, and $13m-1$ are all squares.
Squares mod 4 must be 0 or 1. Considering $2m-1$, so m must be odd. Put $m = 2k+1$. Then, $10k + 4 = b^2$. So, b must be even, so k must be even. Put $k = 2h$, then $5k+1$ is a square. Similarly, $52h + 12$ is a square, so $13h + 3$ is a square. Hence $(13h+3) - (5h+1) = 8h + 2$ is a difference of two squares, which is impossible (a difference of two squares must be 0, 1, or 3 mod 4).
Hence, choice (1) is correct.

18. (1) Let C be the set of n clowns. Label the colours 1, 2, 3, …, 12. For each $i = 1, 2, \ldots, 12$, let E_i denote the set of clowns who use colour i. For each subset S of {1, 2, … 12}, let E_S be the set of clowns who use exactly those colours in S. Since, $S \neq S'$ implies $E_S \neq E_{S'} = \phi$, we have

$$\sum_S |E_S| = |C| = n,$$

where S runs over all subsets of {1, 2, …, 12}.
Now for each i, $E_S \subseteq E_i$ if and only if $i \in S$, and hence $|E_i| = \sum_{i \in S} |E_S|$
By assumption we know that $|E_i| \leq 20$ and that if $E_S \neq \phi$, then $|S| \geq 5$. From this, we obtain

$$20 \times 12 \geq \sum_{i=1}^{12} |E_i| = \sum_{i=1}^{12} \left(\sum_{i \in S} |E_S|\right) \geq 5 \sum_S |E_S| = 5n$$

Therefore, $n \leq 48$
Now, define a sequence $\{C_i\}_{i=1}^{52}$ of colours in the following way

1234 | 5678 | 9 10 11 12|
4123 | 8567| 12 9 10 11|
3412| 7856| 11 12 9 10|
2341|6785| 10 11 12 9| 1234

The first row lists $c_1, \ldots, c_{12}$ in order, the second row lists $c_{13}, \ldots, c_{24}$ in order, the third row lists $c_{25}, \ldots, c_{36}$ in order, and finally the last row lists $c_{37}, \ldots, c_{52}$ in order. For each $j, 1 \leq j \leq 48$, assign colours $c_j, c_{j+1}, c_{j+2}, c_{j+3}, c_{j+4}$ to the jth clown. It is easy to check that this assignment satisfies all conditions given above. So, 48 is the largest for n.

The fact that $n \leq 48$ can be obtained in a much simpler observation that

$$5n \leq 12 \times 20 = 240$$

There are many other ways of constructing 48 distinct sets consisting of 5 colours. For example, consider the sets

{1, 2, 3, 4, 5, 6}, {3, 4, 5, 6, 7, 8}, {5, 6, 7, 8, 9, 10}, {7, 8, 9, 10, 11, 12}, {9, 10, 11, 12, 1, 2}, {11, 12, 1, 2, 3, 4}, {1, 2, 5, 6, 9, 10}, {3, 4, 7, 8, 11, 12}

Each of the above 8 sets have six distinct subsets consiting of exactly five colours. It is easy to check that the 48 subsets obtained in this manner are all distinct.

Hence, choice (1) is correct.

Solutions (Q. 19 and 20)
The problem can be solved in three weighings when the weights are known and in four weighings when the weights are not known.
Let the two samples be $\{A, B, C\}$ and $\{P, Q, R\}$ and let w_i be the result of the ith weighing.

19. (4) Weigh A and P. If $w_1 = 2a$, then both coins are counterfeit. Otherwise, weigh B and Q next. If $w_1 = w_2 = 2b$, then C and R are counterfeit. If $w_1 = w_2 = a + b$, then C and R must be genuine; weigh A to determine its status; if, for example, A is genuine, then B and P are counterfeit. Finally, suppose, say, that $w_1 = 2b$ and $w_2 = a + b$, then A and P are genuine and one of B and Q is counterfeit, as is one of C and R. A third weighing to discover the status of B will allow one to deduce the status of the remaining coins. The problem cannot be solved in two weighings. There is no point in putting all coins from either lot on the scale as this would provide no new information. Since learning the weight of one coin in a sample is equivalent to learning the total weight of the other two, the effective choices for a weighing are : (1) one coin (say A); (2) one coin from each sample (say A and P); (3) one coin from one sample and two from the other (say A, P, Q).
Suppose that a single coin A was selected for the first weighing and found to be genuine. Then the second weighing would identify the two counterfeit coins only if they were the only two coins either put on the scale or left off the scale. But ensuring the first possibility would require one coin from each sample on the second weighing while ensuring the second would require three coins on the scale, and these two options are inconsistent. Thus, the determination cannot be made sure in two weighings. Suppose that one coin from each sample was taken on the first weighing and at least one found to be genuine. If both were found to be genuine, then the second weighing

would have to involve at least one coin from each pile. If the second weighing revealed all genuine or two counterfeit coins, then this would settle the matter only if it involved exactly one coin from each pile. But in this case, if the second weighing resulted in one genuine and one counterfeit coin, we would not know when coin in either weighing was counterfeit.

Finally, suppose *A, P* and *Q* were weighed to begin with. If all were genuine, then the second weighing would identify the two remaining counterfeit coins only if they were the only two coins on the scale, and we cannot guarantee this in advance.

20. (3) On the first three weighings, weigh the sets $\{A, P\}$, $\{B, Q\}$ and $\{C, R\}$. Two of the three weights must be the same, either $2b, 2b, 2a$ in some order or $a+b, a+b, 2b$ in some order. Suppose, without loss of generality, that $w_1 = w_2$. For the fourth and final weighing, select *A* and obtain the weight w_4. If $w_4 = w_1/2 = w_2/2$, then A, P, B and Q weigh the same and C and R are counterfeit. If $w_4 = w_3/2$, then *A* is genuine and *B* and *P* are counterfeit. If w_4 has neither of these values, then *A* is counterfeit along with *Q*. Three weighings do not suffice. A single weighing gives absolutely no information about the character of the coins since we do not know *a* and *b*. Essentially, all we find out is the average weight of a coin. Suppose the average weight of a coin in the first weighing is *p* and the average weight of a coin in the second weighing is *q*. Either $p = q$ or $p \neq q$. There are nine possibilities for the pair of counterfeit coins, and one of the outcomes from the first two weighings must leave at least five of them extant. If *r* is the average weighing of the coins in the third weighing, there are at most three outcomes (whether *r* is equal to none, one or both of *p* and *q*), and this does not suffice to distinguish among the five possibilities.

Comment : Another suggested possibility is to weigh a fixed coin of one pile with each of the coins in the second pile for the first three weighings. This will identify the counterfeit coin in the second pile. Now take it from there.

Alternatively : For the first two weighings, weigh *A* and *B* individually. If *A* and *B* weigh the same, then we know that *C* is counterfeit and what the weight of a genuine coin is. For the third and fourth weighings, weigh *P* and *Q*, and the situation can now be determined. Suppose that the weights are different, *ie*, $w_1 \neq w_2$. We know that *C* must be genuine. For the third weighing, weigh *C* and *P*. If the result is $2w_1$, then *P* must be genuine and we know that the counterfeit coin must weigh w_2; now weigh *Q* to determine its status, and so deduce the status of *R*. If the weight is $2w_2$, then we can conduct a similar analysis. If the result is $w_1 + w_2$, then *P* must be counterfeit (since *C* is genuine). Now, weigh *Q* to find the weight of a genuine coin and so determine which of *A* and *B* is genuine.

21. (2) Using AM-GM inequality, we obtain

$$\frac{1}{r^2} = \frac{2}{ab} = \frac{2ab}{a^2b^2} \le \frac{a^2+b^2}{a^2b^2} \le \frac{1}{a^2} + \frac{1}{b^2} \quad \ldots(i)$$

consequently, if we let S_l be the sum of the squares of the reciprocals of the numbers written on the board after *l* operations, then S_l increases as *l* increases, that is,

$$S_0 \le S_1 \le \ldots \le S_{k^2-1} \quad \ldots(ii)$$

Therefore, if we let *S* be the smallest real number written on the board after $k^2 - 1$ operations, then $\frac{1}{s^2} \ge \frac{1}{t^2}$ for any number *t* among k^2 members on the board and hence $k^3 \times \frac{1}{s^2} \ge S_{k^2-1} \ge S_0 = \frac{1}{r^2}$ which implies that $S \le kr$ as desired.

Hence, choice (2) is correct.

22. (4) A common rational root must be 1 or −1, in which case the respective values of *p* are 0 and 2. These roots are shared with $x^2 - 1 (a = 0, b = 1)$. Suppose that there is a common non-rational root *r*. Then, $r^2 = ar + b$ so that $r^4 = a^2r^2 + 2abr + b^2 = (a^3 + 2ab)r + (a^2b + b^2)$ whence

$$pr + 1 = r^5 = (a^3 + 2ab)r^2 + (a^2b + b^2)r$$
$$= (a^4 + 3a^2b + b^2)r + b(a^3 + 2ab).$$

Since, *r* is not rational,

$$p = a^4 + 3a^2b + b^2$$

and $1 = b(a^3 + 2ab)$.

Hence, $2ap - 1 = 2a^5 + 5a^3b$,

So that, $5a^3b = 2ap - 2a^5 - 1$.

Thus, $1 = \left(\frac{-2a^5 + 2ap - 1}{5a^3}\right)\left(a^3 + \frac{-4a^5 + 4pa - 2}{5a^2}\right)$

from which we obtain that

$$25a^5 = (-2a^5 + 2pa - 1)(a^5 + 4pa - 2)$$

This simplifies to

$$a^{10} + 3pa^6 + 11a^5 - 4p^2a^2 + 4pa - 1 = 0$$

This is a polynomial equation for *a* with integer coefficients. In order that *a* be rational, it must be an integer dividing 1. Hence $a = \pm 1$. If $a = 1$, then $1 = b(1 + 2b)$, whence $b = 1/2$ or $b = -1$. The first value does not give an integer value of *p*, but the second yields $p = -1$. In this case, the two polynomials are $x^2 - x + 1$ and $x^5 + x - 1 = (x^2 - x + 1)(x^3 + x^2 - 1)$ with common roots $-w$ and $-w^2$, where *w* is an imaginary cube root of unity. If $a = -1$, we get the equation $2b^2 + b + 1 = 0$ which is satisfied by no rational value of *b*. Thus, the possibilities are $p = -1, 0, 2$.

Hence, choice (4) is correct.

Alternatively : The rational root case can be handled as in the first solution. By long division, we find that

$$x^5 - px - 1 = (x^2 - ax - b)[x^3 + ax^2 + (a^2 + b)x$$
$$+ (a^3 + 2ab)] + (a^4 + 3a^2b + b^2 - p)x + (a^3b + 2ab^2 - 1)$$

If *r* is a non-rational root of the quadratic and the quintic, then its quadratic conjugate is also. So, the quadratic must divide the quintic and both coefficients of the foregoing division must vanish. Hence, $p = a^4 + 3a^2b + b^2$ and $1 = b(a^3 + 2ab)$, and we can proceed as in the previous (or first) solution.

23. (2) Note that E occurs two times

$\therefore$ Required number of ways $= \frac{6!}{2!} = 360$

24. (2) $T_1 = 3^1 - 2$

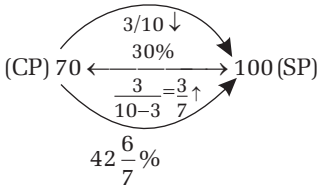
$T_2 = 3^2 - 2$

$T_3 = 3^3 - 2$

$T_4 = 3^4 - 2$

$\therefore \quad T_{33} = 3^{33} - 2$

25. (1) From percentage change graphic



SECTION II

Solutions (Q. 26-29)

From the information given, the three schedules possible are as follows

Schedule I

Programme/ show	Time slots				
	Mon/ Tues	Tues/ Wed	Wed/ Thurs	Thurs/ Fri	Fri/ Satur
Sexciting	11–1	11–1	11–1	11–1	11–1
Nite Bite		2 : 30–4	2 : 30–4		2:30–4
Sextempore	2–5			2–5	
Sexcursion		4–6	4–6		4–6

Sexcursion can be tetecast on any two of the three time slots available for the same.

Schedule II

Programme/ show	Time slots				
	Mon/ Tues	Tues/ Wed	Wed/ Thurs	Thurs/ Fri	Fri/ Satur
Sexciting	4–6	4–6	4–6	4–6	4–6
Nite Bite	1–3			1–3	
Sextempore		12–2	12–2		12–2
Sexcursion	11–1	2–4	2–4	11–1	2–4

Sexcursion can be tetecast on any two of the five 2-hour slots available for the same.

Schedule III

Programme /show	Time slots				
	Mon/ Tue3s	Tues/ Wed	Wed/ Thurs	Thurs/ Fri	Fri/ Satur
Sexciting	4–6	4–6	4–6	4–6	4–6
Nite Bite		2:30–4	2:30–4		2:30–4
Sextempore		12–2	12–2		12–2
Sexcursion	11–4			11–4	

Sexcursion can be telecast on any one of the two 5-hour time slots, for four hours, available for the same.

26. Choice (5) **27.** Choice (5)

28. Choice (4) **29.** Choice (5)

Solutions (Q. 30-32)

Day	Aone	Btwo	Cthree
Monday	10	20	40
Tuesday	30	30	65
Wednesday	40	45	60
Thursday	30	40	50
Friday	30	40	55
Saturday	20	50	50

30. (1) If you convert your 10000 INR into Aone on Monday and carry till Tuesday and on Tuesday. You convert your Aone into INR, then your amount an Tuesday will be 30000.

Again the same day (*ie,* on Tuesday) convert your 30000 INR into Btwo. To maximise your amount you have to convert your Btwo into INR and that will be 45000 INR on Wednesday. Again hold your INR till Thursday and convert your INR into Cthree.

Further convert your Cthree on Friday a into INR, the amount will be 49500 INR. Immediately convert INR into Btwo on the Friday and hold till Saturday, on Saturday convert the Btwo into INR, it will be 61875 INR. Hence, gain = 51875 INR

Hence, choice (1) is correct.

31. (2) **Case I** Consider Atwo as Zeera

Then, Monday: 10000 INR; Wednesday: 40000 INR; Friday: $\frac{40000 \text{ INR}}{40}$ = 1000 Btwos

or $\frac{40000 \text{ INR}}{50} \times 1.1 = 880$ Cthrees.

Case II Consider Btwo as Zeera

Then, Monday: 10000 INR; Wednesday: 22500 INR; Friday: $\frac{22500}{30}$ = 750 Aones

or $\frac{22500}{50} \times 1.1 = 495$ Cthrees.

Case III Consider Cthree as Zeera

Then, Monday: 10000 INR; Wednesday: 15000 INR; Friday: $\frac{15000}{50} \times 1.1 \times \frac{55}{30} = 605$ Aones

or $\frac{15000}{50} \times 1.1 \times \frac{55}{40} = 453.75$ Btwos.

Since, only choice (2) matches, hence it could be the number of Jeeras.

32. (3) If Xeera is Cthree and Jeera is Btwo, then choice (1) and (2) are correct.

If Xeera is B two and Jeera is Aone, then choice (4) and (5) are correct.

Solutions (Q. 33 and 34)

Passenger	P_1	P_2	P_3	P_4	P_5	P_6	P_7
Intended seat	103/106	107	101	102	106/103	105	104
Received seat	101	107	102	105	106	103	104

33. Choice (4) **34.** Choice (1)

Solutions (Q. 35-38)

Year	No. of Students	Lowest	Average	Highest	Maximum Marks	% Lowest	% Average	% Highest	Total Marks
2001	48	22	66	98	100	22	66	98	3168
2002	50	30	70	110	120	25	58.33	91.66	3500
2003	45	31	73	112	120	25.83	60.83	93.33	3285
2004	60	25	80	120	125	20	64	96	4800
2005	70	32	110	140	150	21.33	73.33	93.33	7700
2006	60	18	88	96	100	18	88	96	5280
2007	50	06	32	46	50	12	64	92	1600
2008	80	11	35	48	50	22	70	96	2800

35. Choice (2) **36.** Choice (3)

37. Choice (4) **38.** Choice (1)

Solutions (Q. 39-42)

39. Choice (2) **40.** Choice (5)

41. Choice (3) **42.** Choice (1)

Solutions (Q. 43-46)

43. Choice (2) **44.** Choice (3)

45. Choice (5) **46.** Choice (4)

Solutions (Q. 47-50)

47. Choice (1) **48.** Choice (4)

49. Choice (1) **50.** Choice (1)

SECTION III

Solutions (Q. 51-55)

51. Choice (4) **52.** Choice (2)

53. Choice (3) **54.** Choice (5)

55. Choice (4)

Solutions (Q. 56-58)

56. Choice (3). 'Conundrum' refers to a paradoxical or confusing problem. 'Harmony' and 'boon' are both positive words, hence not appropriate for the context. 'Unanimity' means complete agreement of a group of people, so can't fit in the context where we require a word with a negative connotation. Maelstrom is too strong a word to be used in context. Only choice (3) is closest in meaning to 'Conundrum'.

57. Choice (3). The term 'feckless' means incompetent or ineffectual.

58. Choice (3). 'Rubicund' means 'ruddy' or 'rosy'.

Solutions (Q. 59 and 60)

59. Choice (3) **60.** Choice (4)

Solution (Q. 61)

61. Choice (2)

Solutions (Q. 62-75)

62. Choice (4). In fact the author's argument revolves around the fact that brand value should be used as measure of nation wealth.

63. Choice (1). See the last sentence of para 8, where the author propounds his/her mantra of brand enhancement.

64. Choice (3). See sentence 4-5 of para 6.

65. Choice (4). Though all of these are mentioned, they are irrelevant in the context of this particular question.

66. Choice (2). Clearly the author works out an argument in this passage.

67. Choice (1). The passage is an exploration of this possibility.

68. Choice (3). See sentence 2-4 of the ninth para.

69. Choice (2). This statement captures the entire essence of the passage.

70. Choice (3). Except for taking risks, all the others are clearly mentioned in the passage.

71. Choice (3). The author's focus is that old faces engender more camaraderie; an unknown element would have shaken the team up and led to better results.

Hence, choice (3) is correct.

72. Choice (1). The author's brief for the managers is innovate or perish. Take risks and challenge established notions.

73. Choice (3). See para 6.

74. Choice (1). That is gist of the passage.

75. Choice (3). Reference to a survey and its finding makes research most likely.