1. c The answer is $^{10}C_2 \times 11 + {}^{11}C_2 \times 10 = 45 \times 11 + 55 \times 10 = 1045$.

2. a At least 1 and at most n are to be selected

$$\Rightarrow {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_n = 63$$

$$\Rightarrow \frac{1}{2}\left(2^{2n+1} - 2\right) = 63$$

$$\Rightarrow n = 3$$

3. c 78 = 100 – x – 2(5)
Therefore, x = 12.

4. c Test the boxes labelled — Red and White.
Now if the ball is Red, label the box — Red
Now the box which has the label White is either Red or Red and White.
However, it cannot be Red.
Hence, it is Red and White.
The last box is White.

5. d F1(–2) = 2 = F(–2)
F1(2) = –2, but F(2) = 2

6. b F1(–2) = 0 = F(2)
F1(2) = –2 = F(–2)
Since, F1(x) = F(–x)

7..b F1(2) = 0 = F(–2)
F1(–2) = –2 = F(2)

8. c F1(2) = –1 = F(2)
F1(–2) = 1 = F(–2)

9.. d Take some values of x and y and put in the given expression find which satisfies the answer choices. Correct choice is (d).

10. c $f\left(G\left(f(1,0)\right), f\left(F\left(f(1,2)\right), G\left(f(1,2)\right)\right)\right)$

$$= f\left(G\left(f(1,0)\right), f(3, -3)\right)$$

$$= f\left(G\left(f(1,0)\right), 0\right)$$

$$= f(-1, 0) = 1.$$

11. c The option (c) yields as x^2.

$$-F\left(f(x,x)\right) \cdot G\left(f(x,x)\right) \div \log_2 16$$

$$-\left(-2x \,.\, 2x\right) \div \log_2 16$$

$$= \frac{4x^2}{\log_2 2^4} = x^2$$

12 a The possibilities are W@W@W@ (or) @W@W@W, where 2 blue and 1 red flag occupy the space marked as @. Hence, the total permutation is 2(3!/2!) = 6.

13.. a Assume some values of A and B and substitute in the options to get the answer.

14.. d Use choices. Put some values and check the consistency.

15. d. Use choices. (a), (b) and (c) could be both negative as well as positive, depending on the values of x and y.

16. a For (a), x, y < – 1. Then value of f(x, y) = $(x + y)^2$ and value of g(x, y) = – (x + y).
Substituting any value of x, y < – 1, we get f(x, y) always greater than g(x, y).

17. d Use choices. For the given set of questions, function j(x, y, z), n(x, y, z) means minimum of x, y, z and h(x, y, z), m(x, y, z) means maximum of x, y, z.
f(x, y, z), g(x, y, z) means the middle value.

18. a. Use choices.

19. b The answer is (b) because the denominator becomes zero.

For questions 20 to22:
In graphs, the horizontal line x represents the values of x and the vertical line represents y, where y = f(x). For different values of x, we get the corresponding values of f(x).

20. c From the graph, x = 2
$\Rightarrow$ f(2) = 1 and x = –2 $\Rightarrow$ f(–2) = 1
Thus, f(2) = f(–2). Hence, f(x) = f(–x)

21. d From the graph, x = 1 $\Rightarrow$ f(1) = 2 and x = –1
$\Rightarrow$ f(–1) = 1
Thus, f(1) = 2f(–1)
Hence, 3f(x) = 6f(–x)

22. b From the graph, x = 4
$\Rightarrow$ f(4) = –2 and x = –4 $\Rightarrow$ f(–4) = 2
Thus, f(4) = –f(–4)
Hence, f(x) = –f(–x)

23. c

$$f(2) = \frac{1}{3},\ f^2(2) = \frac{3}{4},\ f^3(2) = \frac{4}{7},\ f^4(2) = \frac{7}{11}, f^5(2) = \frac{11}{18}$$

Answer is $\frac{1}{18}$.

24. b $f^1(-2) = -1$
$f^2(-2) = 0$

$f^3(-2) = \frac{1}{1}$

Sum = 0

25. b Solving these equations, we get 6 distinct lines.
$x + y = 1$, $x + y = -1$, $x = 1$, $x = -1$, $y = 1$ and $y = -1$.
Tracing these curves, we get the area common as 3 square units.

26. b 60 is wrong because then to arrive at a total of 121, the other box will have to weigh 61 kg which will be obviously not the highest. 64 is wrong too, because then to add up to 121, the other weight will have to be 57 and to make up to a total of 120, the next box shall have a weight 63 which obviously makes the maximum possible total as 64 + 63 = 127. 62 is the correct answer because the other boxes shall be 59, 54, 58, 56. These will give all the totals given above.

27. b. $g(1) = f[f(1)] + 1 = 2$. Since f(1) has to be 1, else all the integers will not be covered. f(n) is the set of odd numbers and g(n) is the set of even numbers.

28. b $f(1, 2) = f(0, f(1, 1))$;
Now $f(1, 1) = f[0, f(1, 0)] = f[0, f(0, 1)] = f[0, 2] = 3$
Hence, $f(1, 2) = f(0, 3) = 4$

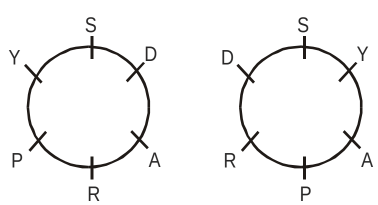
29. c Since he has to put minimum 120 oranges and maximum 144 oranges, i.e. 25 oranges need to be filled in 128 boxes with same number of oranges in the boxes.
There are 25 different possibilities if there are 26 boxes, at least 2 boxes contain the same number of oranges (i.e. even if each of the 25 boxes contains a different number of oranges, the 26th must contain one of these numbers).
Similarly, if there are 51 boxes at least 3 boxes contain the same number of oranges.
Hence at least 6 boxes have same number of oranges for 128 boxes.

30. a Number of regions = $\frac{n(n+1)}{2} + 1$, where n = Number of lines, i.e. for 0 line we have region = 1.
For 1 line we have region = 2.
It can be shown as:

Number of lines	0	1	2	3	4	5	…	10
Number of regions	1	2	4	7	11	16	…	56

Therefore, for n = 10, it is $\frac{10 \times 11}{2} + 1 = 56$

31. c



Before After

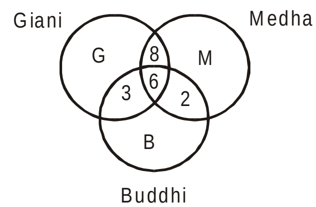
32. a $11 \times 10 \times 9 \times 8 = 7920$

33. c Total number of passwords using all letters – Total number of passwords using no symmetric letters
$= (26 \times 25 \times 24) - (15 \times 14 \times 13) = 12870$

34. d A black square can be chosen in 32 ways. Once a black square is there, you cannot choose the 8 white squares in its row or column. So the number of white squares avaibale = 24
Number of ways = $32 \times 24 = 768$

35. d Putting the value of M in either equation, we get $G + B = 17$.
Hence neither of two can be uniquely determined.

36. b As per the given data we get the following:



$G + B = M + 16$
Also, $M + B + G + 19 = (2 \times 19) - 1$
i.e. $(G + B) = 18 - M$
Thus, $M + 16 = 18 - M$
i.e. $M = 1$

37. c Let the number of correct answers be 'x', number of wrong answers be 'y' and number of questions not attempted be 'z'.
Thus, $x + y + z = 50$ … (i)

And $x - \frac{y}{3} - \frac{z}{6} = 32$

The second equation can be written as,
$6x - 2y - z = 192$ … (ii)
Adding the two equations we get,

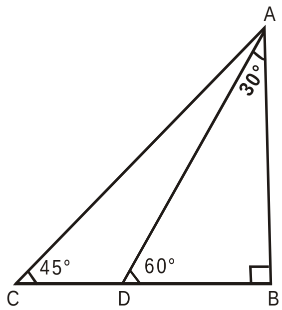
$7x - y = 242$ or $x = \frac{242}{7} + y$

Since, x and y are both integers, y cannot be 1 or 2. The minimum value that y can have is 3.

38. b The number 27 has no significance here.
Statement b, will never be true for any number of people.
Let us take the case of 2 people.
If A knows B and B only knows A, both of them have 1 acquaintance each. Thus, B should be knowing atleast one other person.
Let us say he knows 'C' as well. So now 'B' has two acquaintances (A and C), but C has only acquaintance (B), which is equal to that of A.
To close this loop, C will have to know A as well. In which case he will have two acquaintances, which is the same as that of C.
Thus the loop will never be completed unless atleast two of them have the same number of acquaintances.
Besides, statements 1, 3 and 4 can be true.

39. d $T_n = a + (n - 1)d$
$467 = 3 + (n - 1)8$
$n = 59$
Half of n = 29 terms
29th term is 227 and 30th term is 235 and when these two terms are added the sum is less than 470.
Hence the maximum possible values the set S can have is 30.

40.. a



Let AB = 1
Therefore, BC =1

$\therefore \tan 60 = \frac{AB}{BD} \quad \therefore \sqrt{3} = \frac{1}{BD}$

$\therefore BD = \frac{1}{\sqrt{3}}$

$\therefore CD = BC - BD$

$= 1 - \frac{1}{\sqrt{3}}$

As time for traveling CD, i.e. $1 - \frac{1}{\sqrt{3}}$ is 10 min.

$\therefore$ Time required for traveling BD $= \frac{\frac{1}{\sqrt{3}}}{1 - \frac{1}{\sqrt{3}}} \times 10$

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

$= \frac{10}{\sqrt{3} - 1}$

$= \frac{10}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1}$

$= \frac{10\left(\sqrt{3} + 1\right)}{2}$

$= 5\left(\sqrt{3} + 1\right)$ min

41. a $g^2 = g * g = h$

$g^3 = g^2 * g = h * g = f$

$g^4 = g^3 * g = f * g = e$

$\therefore n = 4$

42. d $f \oplus [f * \{f \oplus (f * f)\}]$

$= f \oplus [f * \{f \oplus h\}]]$

$= f \oplus [f * e\}]$

$= f \oplus [f]]$

$= h$

43. a $e^8 = e^2 * e^2 * e^2$

$= e * e * e$

$= e$

If we observe a $*$ anything = a

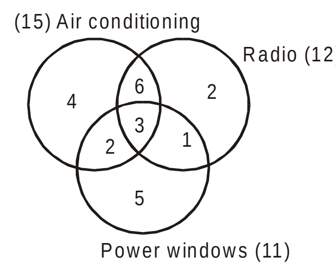
$\therefore a^{10} = a$

$\therefore \{\underline{a^{10} * (f^{10} \oplus g^9)}\} \ \oplus e^8$

$= a \oplus e$

$= e$

44. d



Total = 4 + 6 + 2 + 2 + 3 + 1 + 5 = 23
$\therefore$ Cars having none of the option = 25 – 23 = 2.

45. b Each person will form a pair with all other persons except the two beside him. Hence he will form (n – 3) pairs.
If we consider each person, total pairs = n (n – 3) but here each pair is counted twice.

Hence actual number of pairs $= \frac{n(n-3)}{2}$

They will sing for $\frac{n(n-3)}{2} \times 2 = n(n-3)$ min

Hence n(n -3) = 28

$\Rightarrow n^2 - 3n - 28 = 0$

$\Rightarrow n = 7$ or -4

Discarding the -ve value: n = 7

46. c $f_1 f_2 = f_1(x) f_1(-x)$

$$f_1(-x) = \begin{cases} -x & 0 \le -x \le 1 \\ 1 & -x \ge 1 \\ 0 & \text{other wise} \end{cases}$$

$$= \begin{cases} -x & -1 \le x \le 0 \\ 1 & x \le -1 \\ 0 & \text{other wise} \end{cases}$$

$f_1 f_1(-x) = 0 \quad \forall x$

Similarly $f_2 f_3 = -(f_1(-x))^2 \ne 0$ for some x

$f_2 f_4 = f_1(-x).\, f_3(-x)$

$= -f_1(-x)\, f_2(-x)$

$= -f_1(-x)\, f_1(x) = 0 \quad \forall x$

47. b Check with options
Option (2)

$f_3(-x) = -f_2(-x)$

$= -f_1(x)$

$\Rightarrow f_1(x) = -f_3(-x)\ \forall x$

48.a Let there be m boys and n girls

$^nC_2 = 45 = \frac{n(n-1)}{2} \Rightarrow n(n-1) = 90 \Rightarrow n = 10$

$^mC_2 = 190 \Rightarrow \frac{m(m-1)}{2} = 190 \Rightarrow m(m-1) = 380 \Rightarrow m = 20$

Number of games between one boy and one girl

$= {}^{10}C_1 \times {}^{20}C_1 = 10 \times 20 = 200$

Hence option (1)

49.c $y^2 = x^2$

$2x^2 - 2kx + k^2 - 1 = 0$
$D = 0$

$\Rightarrow 4k^2 = 8k^2 - 8$

$\Rightarrow 4k^2 = 8$

$\Rightarrow k = \sqrt{2}$

50.a The equation forming from the data is x + y < 41
The values which will satisfy this equation are
(1, 39), (1, 38) …… (1, 1)
(2, 38), (2, 37) ,….(2, 1)
(39, 1)
So the total number of cases are 39 + 38 + 37 + …. + 1.

$= \frac{39 \times 40}{2} = 780$

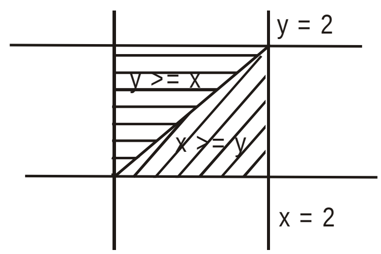
51. c Let $x \ge 0, y \ge 0$ and $x \ge y$

Then $|x + y| + |x - y| = 4$

$\Rightarrow$ x + y + x –y = 4 $\Rightarrow$ x = 2

and in case $x \ge 0, y \ge 0, x \le y$

x + y + y –x = 4 $\Rightarrow$ y = 2



Area in the first quadrant is 4.
By symmetry, total area = 4 × 4 = 16 units

52. d g(x + 1) + g(x –1) = g(x)
g(x+ 2) + g(x) = g(x +1)
Adding these two equations we get
g(x+2) + g(x –1) = 0
$\Rightarrow$ g(x+3) + g(x) = 0
$\Rightarrow$ g(x+4) + g(x + 1) = 0
$\Rightarrow$ g(x+5) + g(x + 2) = 0
$\Rightarrow$ g(x+6) + g(x +3) = 0
$\Rightarrow$ g(x+6) – g(x) = 0