ANSWER KEY

1.	(A)	**13.**	(B)	**25.**	(B)	**37.**	(A)
2.	(B)	**14.**	(A)	**26.**	(B)	**38.**	(1/18)
3.	(B)	**15.**	(C)	**27.**	(D)	**39.**	(A)
4.	(C)	**16.**	(B)	**28.**	(E)	**40.**	(A)
5.	(B)	**17.**	(A)	**29.**	(C)	**41.**	(C)
6.	(E)	**18.**	(B)	**30.**	(B)	**42.**	(A)
7.	(E)	**19.**	(B)	**31.**	(D)	**43.**	(C)
8.	(C)	**20.**	(A)	**32.**	(A)	**44.**	(A)
9.	(C)	**21.**	(B)	**33.**	(E)	**45.**	(D)
10.	(C)	**22.**	(C)	**34.**	(A)	**46.**	(C)
11.	(E)	**23.**	(D)	**35.**	(C)		
12.	(A)	**24.**	(A)	**36.**	(B)		

SOLUTIONS

1. **(A)**

$P(0 \text{ heads}) + (2 \text{ heads}) + P(4 \text{ heads})$

$= \frac{{}^5C_0 + {}^5C_2 + {}^5C_4}{2^5}$

$= \frac{16}{32} = \frac{1}{2}.$

2. **(B)**

$P(H) = 2P(T)$

But $P(H) + P(T) = 1$

$P(H) = \frac{2}{3}$ and $P(T) = \frac{1}{3}$

Out of 5 tosses, any 3 has to be heads

$\Rightarrow {}^5C_0 \times \left(\frac{2}{3}\right)^3 \times \left(\frac{1}{3}\right)^2 = \frac{80}{243}$

3. **(B)**

If first dice gives 1, the second dice can be any number from 2 to 6.
Similmarly, the favourable events are (1, 2) … (1, 6), (2, 3)…(2,6), (3,4), (3,5), (3,6), (4, 5), (4, 6), (5, 6).
So total = 15

$\frac{15}{36} = \frac{5}{12}$

4. **(C)**

The different triplets where one is the sum of other two are (1, 1, 2), (1, 2, 3), (2, 2, 4), (1, 3, 4), (1, 4, 5), (2, 3, 5), (1, 5, 6), (2, 4, 6), (3, 3, 6) (1, 1, 2) can be arranged in $\frac{3!}{2!} = 3$ ways

Similarly (1, 2, 3) can be arrange in 3! = 6 ways.

So, total number of ways = 3 + 6 + 3 + 6 + 6 + 6 + 6 + 6 + 3 = 45

Required Probability = $\frac{45}{6^3} = \frac{5}{24}$

5. **(B)**

Different possibilities are

Kings	**Queens**
1	0
2	0 or 1
3	0

Number of favourable events are ${}^4C_1 \times {}^{44}C_2 + {}^4C_2 \times {}^{44}C_1 + {}^4C_2 \times {}^4C_1 + {}^4C_3$
= 3784 + 264 + 24 + 4 = 4076

$= \frac{4076}{5203}$

6. **(B)**

Total cases = ${}^{52}C_4$
The different possibilities are

Red	**Black**
0	4
1	3
2	2
3	1
4	0

Favourable outcomes
$= 2 \times {}^{26}C_4 + 2 \times {}^{26}C_3 \times {}^{26}C_1 + {}^{26}C_2 \times {}^{26}C_2$

7. **(E)**

The two balls can be (W, R), (W, G), (W, Y), (R, G), (R, Y), (G, Y).

$= \frac{3\times2+3\times3+3\times2+2\times3+2\times2+3\times2}{{}^{10}C_2}$

$= \frac{37}{45}$

8. **(C)**

$P(\text{Bag } A) \times P(2 \text{ green}) + P(\text{Bag } B) \times P(2 \text{ green})$

$=\frac{1}{2}=\frac{{}^{6}C_2}{{}^{12}C_2}+\frac{1}{2}\times\frac{{}^{2}C_2}{{}^{9}C_2}=\frac{101}{792}$

9. (C)

The numbers which have at least one 9 are 9, 19, 29,..., 89, 90, 91, ... 99.
So total 9 + 10 = 19

So, answer $=\frac{19}{100}$

10. (C)

It is given that, $p(k)=k\times p(1)$

But $p(1)+p(2)+...+p(6)=1$

$p(1)(1+2+3+4+5+6)$

$\Rightarrow p(1)=\frac{1}{21}$

$p(1)+p(3)+p(5)=\frac{1+3+5}{21}=\frac{3}{7}$

11. (E)

$\frac{7!-2\times6!}{7!}$ or $1-\frac{2\times6!}{7!}=\frac{5}{7}$

12. (A)

$P(3\text{ multiple})P(2\text{ blue})+P(5\text{ multiple})$

$P(2\text{ blue})+P(\text{neigher 3, nor 5})\times P(2\text{ blue})$

$=\frac{1}{3}\times\frac{{}^{2}C_2}{{}^{10}C_2}+\frac{1}{6}\times\frac{{}^{4}C_2}{{}^{9}C_2}+\frac{1}{2}+\frac{2}{10}\times\frac{4}{9}=\frac{43}{540}$

13. (B)

Probability of getting defective bolt, which is manufactured by machine

$=\frac{4}{100}\times\frac{35}{100}=\frac{140}{10000}$

Probability of getting a defective bolt

$P(D)=\frac{5}{100}\times\frac{25}{100}+\frac{4}{100}+\frac{2}{100}\times\frac{40}{100}$

Required probability

$=\frac{P(D_B)}{P(D)}=\frac{\frac{140}{10000}}{\frac{345}{10000}}=\frac{140}{345}=\frac{28}{69}$

14. (A)

If the sum is an odd number, both the numbers can not be odd. (odd + odd = even).

15. (C)

The number is divisible by 4, if the last 2 digits are (0, 4), (2, 0), (2, 4),(3, 2),(4, 0),(5, 2). So, (3 × 3 × 2 + 3 × 2 × 2) numbers are divisible by 4.
Total numbers that can be formed are

$4\times4\times3\times2=96=\frac{30}{96}=\frac{5}{16}$

16. (B)

There will be 10 such pairs, which are neighbours.
But in total, 2 points can be selected from 11 in ${}^{11}C_2$ ways.

So, $=\frac{10}{{}^{11}C_2}=\frac{2}{11}$

17. (A)

Both can be unit (1 × 1) squares, or 2 × 2 squares or 3 × 3 squares.
So, favourable cases are

${}^{16}C_2+{}^{9}C_2+{}^{4}C_2$

Total cases $={}^{(16+9+4+1)}C_2={}^{30}C_2$

Required probability $=\frac{162}{435}=\frac{54}{145}$

18. (B)

Required probability

$1-P(\text{not solved})=1-P(\bar{A})P(\bar{B})P(\bar{C})$

$=1-\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}=\frac{3}{4}$

19. (B)

Required probability

$=\frac{p(R).p(B_1)}{p(R).p(B_1)+p(R).p(B_2)+p(R).p(B_3)}$

$=\frac{\frac{3}{12}+\frac{1}{3}}{\frac{3}{12}\times\frac{1}{3}+\frac{4}{10}\times\frac{1}{3}+\frac{5}{11}\times\frac{1}{3}}$

$=\frac{\frac{3}{12}}{\frac{3}{12}+\frac{4}{10}+\frac{5}{11}}=\frac{55}{243}$

20. (A)

Probability that P_1 be solved $=1-\frac{2}{3}\times\frac{1}{2}=\frac{2}{3}$

Probability that P_2 be solved $=1-\frac{1}{2}\times\frac{2}{3}=\frac{2}{3}$

Probability that P_3 be solved =

$1-\frac{1}{3}\times\frac{1}{4}=\frac{11}{12}$

Probability that all the problems will be solved

$=\frac{2}{3}\times\frac{2}{3}\times\frac{11}{12}=\frac{11}{27}$

21. (B)

Probability that atleast 1 problem will be solved

$=1-p(\text{number problem is solved})$

$=1-\frac{1}{3}\times\frac{1}{3}\times\frac{1}{12}=\frac{107}{108}$

22. (C)

$\frac{1}{2}\times\frac{2}{16}+\frac{1}{2}\times\frac{B}{5+B}=\frac{1}{4}\Rightarrow B=3$

23. (D)

$P(A):P(\bar{A})=3:4\Rightarrow P(A)=\frac{3}{7}$

$P(\bar{B}):P(B)=4:5 \Rightarrow P(B)=\frac{5}{9}$

$P(A).P(B)=\frac{5}{21}$

24. **(A)**

Since, the probability that Australia won the 1st match is 1, India has to win all the remaining three matches to win the series.

i.e. $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)=\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}=\frac{1}{4}$

25. **(B)**

Since, the probability that Australia won the 1st match is 1, i.e. Australia already won the first match. So, out of the remaining three, it has to win only one more match. The possibilities for the winners of the remaining three matches can be: AII or IAI or IIA

$\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}+\frac{1}{2}\times\frac{1}{3}\times\frac{3}{4}+\frac{1}{2}\times\frac{2}{3}\times\frac{1}{4}$

$=\frac{1}{4}+\frac{1}{8}+\frac{1}{12}=\frac{11}{24}$

26. **(B)**

p(prime) $=\frac{3}{6}$

p(composite) $=\frac{2}{6}$

p(neither prime nor composite) $=\frac{1}{6}$

Profit/loss $=\left(\frac{3}{6}\times30+\frac{2}{6}\times0+\frac{1}{6}\times50-20\right)$

= Rs. 3.33

% profit $=\frac{3.33}{20}\times100=16.66\%$

27. **(D)**

The total number of outcome $=2^4=16$

The number of favorable outcome $=(TTTT)=1$

Probability $=\frac{1}{16}$

28. **(E)**

There are 26 red card and 4 aces. But out of these, 2 aces are of red color.

So, the required probability $=\frac{26+2}{52}=\frac{7}{13}$

29. **(C)**

Favourable cases = 2, 3, 5, 7, 11, 13, 17, 19 and 23

Hence, the probability $=\frac{9}{25}$

30. **(B)**

The required probability

$=\frac{{}^8C_3}{{}^{13}C_3}=\frac{8\times7\times6}{13\times12\times11}=\frac{28}{143}$

31. **(D)**

No. of ways of drawing 2 cards $={}^{52}C_2$

i.e. Total no. of cases ${}^{52}C_2$

Favorable cases 1st is a king and 2nd is a queen or 1st is a queen and 2nd is a king.

∴ Required probability

$=\frac{{}^4C_1\times{}^4C_1}{{}^{52}C_2}=\frac{4\times4}{52\times51}\times2=\frac{8}{663}$

32. **(A)**

The probability that the 2 balls drawn are of same color = The probability that both are white or both are black

$=\frac{{}^6C_2}{{}^{10}C_2}+\frac{{}^4C_2}{{}^{10}C_2}$

The required Probability $=\frac{{}^6C_2+{}^4C_2}{{}^{10}C_2}$

$=\frac{6\times5+4\times3}{10\times9}=\frac{42}{90}=\frac{7}{15}$

33. **(E)**

The natural numbers which are divisible by 3

$=\frac{500}{3}\times166$

The natural numbers which are divisible by 5

$=\frac{500}{5}\times100$

The natural number which are divisible by 15

$=\frac{500}{15}\times33$

The natural numbers, which are divisible by either 3 or 5 $=3\text{or }5=P(3)+P(5)-P(3\text{ and }5)$

$=166+100-33=233$

Required probability $=\frac{233}{500}$

34. **(A)**

Number of ways of selecting a numbered card from pack of $52={}^{13}C_1=13$

Number of ways of selecting the three same numbered cards as the one earlier selected $={}^3C_3=1$

∴ Probability of getting all four cards of same numbers $=\frac{13\times1}{{}^{52}C_4}=\frac{13\times4\times3\times2}{52\times51\times50\times49}=\frac{13}{270725}$

35. **(C)**

The total number of 5 digit numbers

$=9\times10\times10\times10t10=10^4\times9$

(Since we cannot place '0' in the ten thousands place, so here we can use 9 numbers.

In the rest of the four places, we can write any of the 10 numbers).

Now, the possible outcome for the number to be divisible by 5 = 9 × 10 × 10 × 10 × 2 (For anumber to be divisible by '5', the units place should have the digit '5' or '0'.)

Hence, the total number of outcomes
$= 9 \times 10^3 \times 2$
So, the required probability
$$= \frac{9\times10^3\times2}{9\times10^4} = \frac{2}{10} = \frac{1}{5}$$

36. (B)
8 boys and girls can be seated on 8 chairs in 8! different ways.
G B G B G B G B G B G
As shown above, 5 boys can be seated at 5 places in 5! ways.
After this, 3 girls can be seated in the remaining 6 places in $^6P_3$ ways.
∴ Favorable outcomes
$$= 5!\times {}^6P_3$$
∴ Probability $\frac{5!}{3!}\times\frac{6!}{8!} = \frac{5}{14}$

37. (A)
The total number of four-digit numbers that can be formed = 4!.
If the number is divisible by 25, then the last two digits are 25.
So, the first two digits can be arranged in 2! Ways.
Hence, probability $\frac{2!}{4!} = \frac{1}{12}$

38. (1/18)
Given that the ball selected is red, there are 6 red balls. The probability that the ball selected is particular red ball, is 1/18

39. (A)
Assume that one coin, say the one showing a tail, is flipped 7 times instead of 7 different coins. Then, it would show a head, and there should be 5 heads and 5 tails.
If by covering a coin, there are 5 tails and 4 heads to be seen, then the covered coin is head. (Verify that this argument holds even if 7 different coins are flipped).

40. (A)
The favorable cases =3,6,9,12,15, 18, 7 and 14
∴ The probability is $= \frac{8}{20} = \frac{2}{5}$.

41. (C)
The number of ways of choosing
1 girl out of 10 = $^{10}C_1$
The number of ways of choosing 2 boys out of 15 = $^{15}C_2$ Total no. of ways of choosing 3 students from (15 + 10) = $^{25}C_3$
∴ Required probability $= \frac{^{10}C_1\times{}^{15}C_2}{^{25}C_3}$

42. (A)
The probability that the 2 balls drawn are of the same color = The probability that both are white or both black
$$= \frac{^6C_2}{^{10}C_2}$$

43. (C)
When the balls drawn are replaced, we can see that the number of balls available for drawing out will be the same for every draw.
This means that all these events shall be independent of each other and shall not impact on other probability of appearance of green ball.
The required probability
$$= \frac{8}{13}\times\frac{8}{13}\times\frac{8}{13} = \left(\frac{8}{13}\right)^3$$

44. (A)
The probability that the yarn selected is green in colour is 25% i.e. $\frac{1}{4}$.

For the green yarn to be defective the probability is 7% i.e. $\frac{7}{100}$.
Hence the probability that the selected yarn is defective and green in colour is
$\frac{1}{4}\times\frac{7}{100} = \frac{7}{400}$.

45. (D)
The probability that the ball drawn, after transferring one ball from the first bag to the second bag is white
= P (ball transferred is white & drawn is also white) or P (ball transferred is black & drawn is white)
$$= \frac{5}{9}\times\frac{8}{17}+\frac{4}{9}\times\frac{7}{17} = \frac{68}{153} = \frac{4}{9}$$

46. (C)
It is given that,
$p(k) = k\times p(1)$
But $p(1)+p(2)+\ldots+p(6) = 1$
$p(1)(1+2+3+4+5+6)$
$$\Rightarrow P(1) = \frac{1}{21}$$
$$P(2)+P(4)+P(6) = \frac{2+4+6}{21} = \frac{4}{7}$$
this happens 3 times
so total
$$P(E) = \frac{4}{7}\times\frac{4}{7}\times\frac{4}{7} = \frac{64}{343}$$