

1 Conventional Questions

1. Required number $= 8 \times 7 \times C_3^{13} + 7 \times 6 \times C_3^{13}$ 1M+1A
 $= 28\,028$ 1A
2. (a) Required number $= C_5^8 C_2^5$ 1M
 $= 560$ 1A
- (b) Required number $= C_3^8 C_4^5 + C_2^8 C_5^5$ 1M
 $= 308$ 1A
3. (a) Required number $= 11!$
 $= 39\,916\,800$ 1A
- (b) Required number $= C_4^8 \times C_3^5 \times 3!4!$ 1M+1M
 $= 100\,800$ 1A

2 Multiple Choice Questions

1. D
Required number $= (C_3^{15} - C_1^{13}) \times 3!$
 $= 2652$
2. B
Required number $= C_4^{12} + C_3^{12} C_1^6$
 $= 1815$
3. A
Required number $= C_4^7 C_2^8 + C_5^7 C_1^8 + C_6^7$
 $= 1155$

4. B

$$(n - 2)180^\circ = 2520^\circ$$

$$n = 16$$

I. ✗.

$$\text{Number of diagonals} = C_2^{16} - 16 = 104$$

II. ✓.

$$\text{Exterior angle} = \frac{360^\circ}{16} = 22.5^\circ$$

III. ✗.

$$\text{Interior angle} = 180^\circ - 22.5^\circ = 157.5^\circ$$

5. C

$$\begin{aligned}\text{Required number} &= C_1^{12} C_3^{11} \\ &= 1980\end{aligned}$$

6. C

$$\begin{aligned}\text{Required number} &= C_3^{12} + C_1^{18} C_2^{12} \\ &= 1408\end{aligned}$$

7. B

$$\begin{aligned}\text{Number of ways} &= C_2^7 C_3^{10} + C_3^7 C_2^{10} + C_4^7 C_1^{10} + C_5^7 \\ &= 4466\end{aligned}$$

8. C

$$\begin{aligned}\text{Required number} &= C_5^{14} + C_4^{14} C_1^{22} + C_3^{14} C_2^{22} \\ &= 108\,108\end{aligned}$$

9. C

$$\begin{aligned}\text{Required number} &= C_6^7 + C_5^7 C_1^5 + C_4^7 C_2^5 + C_3^7 C_3^5 \\ &= 812\end{aligned}$$

10. D

$$\text{Each exterior angle} = 180^\circ - 162^\circ = 18^\circ$$

$$\text{Number of sides} = \frac{360^\circ}{18^\circ} = 20$$

I. ✗.

$$\text{Number of diagonals} = C_2^{20} - 20 = 170$$

II. ✓.

III. ✓.

11. B

$$\begin{aligned}\text{Required number} &= C_2^3 C_1^5 C_1^2 + C_1^3 C_2^5 C_1^2 + C_1^3 C_1^5 C_2^2 \\ &= 105\end{aligned}$$

12. C

$$\begin{aligned}\text{Required number} &= C_2^{14} C_2^{16} + C_3^{14} C_1^{16} + C_4^{14} \\ &= 17\,745\end{aligned}$$

13. A

$$\begin{aligned}\text{Required number} &= C_3^{18} C_3^{12} + C_4^{18} C_2^{12} + C_5^{18} C_1^{12} + C_6^{18} \\ &= 502\,860\end{aligned}$$

14. A

$$\begin{aligned}\text{Required number} &= C_2^{12} C_6^{10} \\ &= 13\,860\end{aligned}$$

15. C

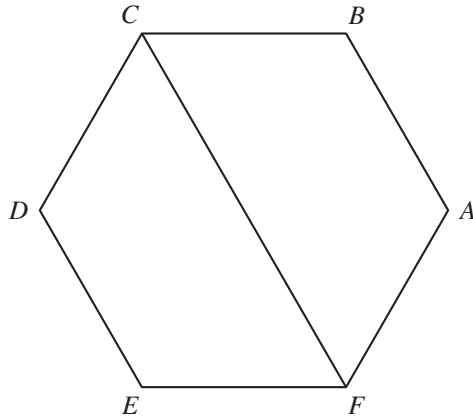
I. ✓.

$$\text{Exterior angle} = \frac{360^\circ}{6} = 60^\circ$$

$$\text{Interior angle} = 180^\circ - 60^\circ = 120^\circ = 2 \times 60^\circ$$

II. ✓.

Refer to the figure.



We have $AB \parallel FC$ by symmetry.

III. ✗.

$$\text{Number of diagonals} = C_2^6 - 6 = 9$$

16. B

$$\begin{aligned} \text{Required number} &= C_1^{11}(C_4^{10} + C_4^7) + C_1^7(C_4^{11} + C_4^6) \\ &= 5110 \end{aligned}$$

17. A

$$\text{Exterior angle} = 180^\circ - 165^\circ = 15^\circ$$

$$n = \frac{360^\circ}{15^\circ} = 24$$

A. ✓.

$$\text{Number of diagonals} = C_2^{24} - 24 = 252$$

B. ✗.

C. ✗.

$$\text{Sum of interior angles} = 24 \times 165^\circ = 3960$$

D. ✗.

18. B

$$\begin{aligned}\text{Required number} &= C_1^{18} C_5^{17} \\ &= 111\,384\end{aligned}$$

19. A

$$\begin{aligned}\text{Required number} &= C_5^{25} - C_5^{15} - C_5^{10} \\ &= 49\,875\end{aligned}$$

20. C

$$\begin{aligned}\text{Required number} &= C_5^{14} - C_5^6 - C_4^6 C_1^8 \\ &= 1876\end{aligned}$$

21. C

$$\begin{aligned}\text{Required number} &= C_3^{30} C_2^{18} + C_4^{30} C_1^{18} + C_5^{30} \\ &= 1\,256\,976\end{aligned}$$

22. A

$$\text{Number of sides} = \frac{360^\circ}{40^\circ} = 9$$

I. ✓.

II. ✗.

$$\text{Interior angle} = 180^\circ - 40^\circ = 140^\circ$$

$$\text{Sum of interior angles} = 140^\circ \times 9 = 1260^\circ$$

III. ✗.

$$\text{Number of diagonals} = C_2^9 - 9 = 27$$

23. B

$$\text{Exterior angle} = 180^\circ - 150^\circ = 30^\circ$$

$$\text{Number of sides} = \frac{360^\circ}{30^\circ} = 12$$

I. ✗.

$$\text{Number of diagonals} = C_2^{12} - 12 = 54$$

II. ✓.

$$\text{Sum of interior angles} = 150^\circ \times 12 = 1800^\circ$$

III. ✗.

24. B

$$\begin{aligned}\text{Required number} &= C_1^{22} \times (C_4^{36} - C_4^{15} - C_4^{21}) \\ &= 1\,134\,210\end{aligned}$$

25. C

Let θ be the exterior angle of the polygon.

$$\theta + 7\theta = 180^\circ$$

$$\theta = 22.5^\circ$$

I. ✓.

$$n = \frac{360^\circ}{22.5^\circ} = 16$$

II. ✗.

III. ✓.

$$\text{Number of diagonals} = C_2^{16} - 16 = 104$$

26. B

$$\begin{aligned}\text{Required number} &= C_4^4 + C_3^4 C_1^5 + C_2^4 C_2^5 \\ &= 81\end{aligned}$$

27. D

Let n be the number of sides of the regular polygon.

$$(n - 2)180^\circ = 360^\circ \times 5$$

$$n = 12$$

$$\text{Exterior angle} = \frac{360^\circ}{12} = 30^\circ$$

$$\text{Interior angle} = 180^\circ - 30^\circ = 150^\circ$$

I. ✓.

II. ✓.

III. ✓.

$$\text{Number of diagonals} = C_2^{12} - 12 = 54$$

28. C

$$\begin{aligned}\text{Required number} &= C_3^{12} C_2^{16} + C_4^{12} C_1^{16} + C_5^{12} \\ &= 35\,112\end{aligned}$$

29. A

Note that the sum of an interior angle and an exterior angle is 180° .

$$\text{Exterior angle} = 180^\circ \times \frac{2}{7+2} = 40^\circ$$

$$\text{Number of sides} = \frac{360^\circ}{40^\circ} = 9$$

I. ✓.

II. ✓.

$$\begin{aligned} \text{III. } \times. \text{ Number of diagonals} &= C_2^9 - 9 \\ &= 27 \end{aligned}$$

30. A

$$\text{Exterior angle} = 180^\circ - 162^\circ = 18^\circ$$

I. ✓.

$$n = \frac{360^\circ}{18^\circ} = 20$$

II. ✓.

III. ✗.

$$\text{Number of diagonals} = C_2^{20} - 20 = 170$$

31. B

$$\begin{aligned} \text{Required number} &= C_2^5 \times 3! \\ &= 60 \end{aligned}$$

$$\begin{aligned} \text{Required number} &= \frac{5!}{2!} \\ &= 60 \end{aligned}$$

32. A

$$\begin{aligned} \text{Required number} &= C_3^7 3! 6! \\ &= 151\,200 \end{aligned}$$

33. D

$$\begin{aligned} \text{Required number} &= C_4^8 4! 7! \\ &= 8\,467\,200 \end{aligned}$$

34. A

$$\begin{aligned}\text{Number of queues} &= 7!5! \\ &= 604\,800\end{aligned}$$

35. A

$$\begin{aligned}\text{Required number} &= 4!5! \\ &= 2880\end{aligned}$$

36. D

$$\begin{aligned}\text{Number of arrangements} &= 8!4! \\ &= 967\,680\end{aligned}$$

37. C

$$\text{Required probability} = \frac{8!3!}{10!} = \frac{1}{15}$$

38. A

$$\begin{aligned}\text{Required number} &= {}^5C_3 3!6! \\ &= 43\,200\end{aligned}$$

39. B

$$\begin{aligned}\text{Required number} &= 8! - 6 \times 2!6! \\ &= 31\,680\end{aligned}$$

40. B

$$\begin{aligned}\text{Number of ways to arrange the first two persons} \\ &= {}^8C_2 \times 2! \\ \text{Required number} \\ &= ({}^8C_2 \times 2!) \times 8! \\ &= 2\,257\,920\end{aligned}$$

Probability that the first two persons are not boys

$$\begin{aligned}&= \frac{{}^8C_2}{{}^{10}C_2} \\ &= \frac{28}{45}\end{aligned}$$

$$\begin{aligned}\text{Required number} &= 10! \times \frac{28}{45} \\ &= 2\,257\,920\end{aligned}$$

41. D

$$\begin{aligned}\text{Required number} &= 3!6!2!3! \\ &= 51\,840\end{aligned}$$

42. C

$$\begin{aligned}\text{Required number} &= 6! \times 3! \\ &= 4320\end{aligned}$$

43. C

$$\text{Required number} = {}^C_3^{10}3!9! = 261\,273\,600$$

44. C

$$\begin{aligned}\text{Required number} &= {}^C_2^82!7! \\ &= 282\,240\end{aligned}$$

45. D

Choose two books of different languages to put at both ends.

There are $C_1^2 \times C_1^4 \times 2!$ ways.

$$\begin{aligned}\text{Required number} &= (C_1^2 C_1^4 2!) \times 4! \\ &= 384\end{aligned}$$

Probability of getting different languages at both ends

$$= \frac{C_1^2 C_1^4}{C_2^6}$$

$$= \frac{8}{15}$$

$$\begin{aligned}\text{Required number} &= 6! \times \frac{8}{15} \\ &= 384\end{aligned}$$

46. C

$$\begin{aligned}\text{Required number} &= (C_4^8 + C_3^8 C_1^6) \times 5! \\ &= 48\,720\end{aligned}$$

47. B

$$\begin{aligned}\text{Required number} &= 4 \times 2!4! \\ &= 192\end{aligned}$$

48. D

$$\begin{aligned}\text{Required number} &= C_2^3 C_3^8 \times C_2^4 2!3! + C_3^3 C_2^8 3!2! \\ &= 12\,432\end{aligned}$$

49. D

$$\begin{aligned}\text{Required number} &= C_1^2 (C_3^5 \times 3!) \times 7! \\ &= 604\,800\end{aligned}$$

$$\begin{aligned}\text{Required number} &= 10! \times \frac{C_3^5 + C_3^5}{C_3^{10}} \\ &= 604\,800\end{aligned}$$

$$\begin{aligned}\text{Required number} &= (C_1^2 C_2^7 \times 5!) \times 5! \\ &= 604\,800\end{aligned}$$

50. A

$$\begin{aligned}\text{Required number} &= C_2^9 2!8! \\ &= 2\,903\,040\end{aligned}$$

51. C

$$\begin{aligned}\text{Required number} &= 9!2! - 8! \\ &= 685\,440\end{aligned}$$

52. C

$$\begin{aligned}\text{Required probability} &= \frac{4!3!}{7!} \\ &= \frac{1}{35}\end{aligned}$$

53. C

$$\begin{aligned}\text{Required number} &= {}^7C_3 {}^5C_3 \times 3!3! \\ &= 12\,600\end{aligned}$$

54. B

$$\begin{aligned}\text{Required number} &= ({}^3C_2 \times 2!) \times ({}^7C_6 \times 6!) \\ &= 30\,420\end{aligned}$$

55. C

$$\begin{aligned}\text{Required number} &= 8!2! \\ &= 80\,640\end{aligned}$$

56. B

$$\begin{aligned}\text{Required number} &= 3!4!3!5! \\ &= 103\,680\end{aligned}$$