Institute of Actuaries of India

ACET May 2024

Mathematics

1. For any two sets A and B, which of the following is FALSE?

A. $\overline{A \cup (B \cup C)} = \bar{A} \cap (\bar{B} \cap \bar{C})$
B. $A \cup (B \cap C) = \overline{\bar{A} \cap (\bar{B} \cup \bar{C})}$
C. $\bar{A} \cup \overline{(B \cap C)} = \bar{A} \cap (\bar{B} \cup \bar{C})$
D. $\overline{A \cap (B \cup C)} = \bar{A} \cup (\bar{B} \cap \bar{C})$

1 mark

2. The value of $\sqrt{42 + \sqrt{42 + \sqrt{42 + \cdots}}}$ is?

A. -6
B. -7
C. 6
D. 7

2 marks

3. The inverse of the matrix $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 1 & 2 \end{bmatrix}$ is

A. $\begin{bmatrix} -0.25 & 0.75 & -0.25 \\ 0.75 & -0.25 & -0.25 \\ -0.25 & -0.25 & 0.75 \end{bmatrix}$
B. $\begin{bmatrix} 0.25 & -0.75 & 0.25 \\ -0.75 & 0.25 & 0.25 \\ 0.25 & 0.25 & -0.75 \end{bmatrix}$
C. $\begin{bmatrix} 0.25 & -0.75 & 0.25 \\ 0.75 & 0.25 & -0.25 \\ -0.25 & 0.25 & 0.75 \end{bmatrix}$
D. $\begin{bmatrix} -0.25 & 0.75 & 0.25 \\ 0.75 & -0.25 & -0.25 \\ -0.25 & -0.25 & 0.75 \end{bmatrix}$

2 marks

4. The value of $\int x + sinx\, dx$ is

A. $\frac{x^2}{2} + cosx + c$
B. $\frac{-x^2}{2} - cosx + c$
C. $\frac{-x^2}{2} + cosx + c$

D. $\frac{x^2}{2} - cosx + c$

1 mark

5. If K = $\begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$ then the matrix KK^T has rank?

A. 1
B. 2
C. 3
D. 4

1 mark

6. Let $\vec{a}, \vec{b}\ and\ \vec{c}$ be mutually perpendicular unit vectors. The value of $\left|\vec{a} + 2\vec{b} + 2\vec{c}\right|$ is

A. 5
B. $\sqrt{8}$
C. 3
D. 4

1 mark

7. If x and y are real and if $(x + iy)\ (2 + 3i)$ is the conjugate of $-5 + 6i$, then x and y are, respectively,

A. x = 28/13, $y = -3/13$
B. x = -28/13, $y = 3/13$
C. x = 8/13, $y = -49/39$
D. x = -8/13, $y = 49/39$

3 marks

8. The area bounded by the curve $y = 2x$, the lines $y = 0$, $x = 1$ and $x = 3$ is

A. 6
B. 15
C. 3
D. 8

1 mark

9. In a college, there were 48 students who play Cricket, 36 students who play Football and 29 students who play Basketball. If only 4 students play all three sports and there are a total of 64 students who play at least 1 sport, then how many students play exactly 2 sports?

A. 53
B. 41
C. 37
D. 49

3 marks

10. The number of points at which f(x) = |x-1| + |2x+1| does not have a derivative is

A. 1
B. 2
C. 3
D. 4

1 mark

11. Suppose n(X), the number of elements in the set is 100, n(Y) = 125, n(X-Y) = 75. Then n(XUY) is equal to?

A. 200
B. 25
C. 100
D. 175

1 mark

12. The set of all subsets of a given set is called

A. Cartesian product
B. Finite set
C. Complementary set
D. Power set

1 mark

13. If $\log_a x = 2$ and $\log_a y = 3$ then $\log_x y$ is

A. 2
B. 2/3
C. 3
D. 3/2

1 mark

14. The value of the integral $\int_0^\infty e^{-x}x^6\,dx$ is

A. 6!
B. 7!
C. -6!
D. -7!

2 marks

15. Given $\log_a 1.8 = 0.255$, find the value of $\log_a 1.5$ using linear interpolation

A. 0.176
B. 0.146

C. 0.159
D. 0.201

2 marks

16. Which of the following is FALSE about Cosine function?

A. Periodic
B. Continuous
C. Differentiable
D. Invertible

1 mark

17. The floor function (or greatest integer function) is the function that takes as input a real number x, and gives as output the greatest integer less than or equal to x. The set of all points of discontinuity is

A. Finite
B. Infinite
C. Universal set
D. Null set

1 mark

18. If $y = \sin^{-1}(x) \log x$,then $\frac{dy}{dx}$ is

A. $\frac{\log x}{\sqrt{1-x^2}} + \frac{\sin^{-1} x}{x}$
B. $\frac{\log x}{\sqrt{1-x}} + \frac{\sin^{-1} x}{x}$
C. $\frac{-\log x}{\sqrt{1-x^2}} + \frac{\sin^{-1} x}{x}$
D. $\frac{\log x}{\sqrt{1-x^2}} - \frac{\sin^{-1} x}{x}$

2 marks

19. If f(x) = (3x-5)/2, then,

A. $f^{-1}(x) = (2x-5)/3$
B. $f^{-1}(x) = (2x+3)/5$
C. $f^{-1}(x) = (2x-3)/5$
D. $f^{-1}(x) = (2x+5)/3$

1 mark

20. If $\log_4 x + \log_8 x + \log_{16} x = 13/3$ then x is equal to

A. 16
B. 8
C. 4
D. 2

2 marks

Statistics

21. What is the probability of rolling a sum of 6 or 8 with two fair six-sided dice?

A. 5/36
B. 5/18
C. 1/3
D. 2/18

1 mark

22. A jar contains 15 red marbles, 10 blue marbles, and 5 green marbles. If a child selects 7 marbles from the jar, in how many ways can they select them such that they receive at most 3 blue marbles?

A. 1,58,140
B. 15,81,400
C. 17,44,200
D. 1,74,420

3 marks

23. Given there are two samples, one with 80 observations and the other with 120 observations. The mean and standard deviation of first sample is 25 and 5. While the mean and variance of both the samples considered together is 22 and 25.6. Find the standard deviation of second sample.

A. 16
B. 8
C. 4
D. 3

3 marks

Answer questions 24-26 based on the table below.

Value	1	2	3	4	5	6	7	8	9	10
Frequency	2	5	8	6	p	6	5	4	3	1

24. Given mean of the distribution as 5, what is the value of p?

A. 5
B. 8
C. 9
D. 10

1 mark

25. What are the median and mode for the same?

A. Median:4, Mode:5
B. Median:5, Mode:3
C. Median:5, Mode:5
D. Median:4, Mode:3

1 mark

26. What are mean, median and mode, if p = 0?

A. Mean: 5, Median:5, mode:5
B. Mean: 5, Median:4, mode:5
C. Mean: 4, Median:4, mode:4
D. Mean: 5, Median:4, mode:3

2 marks

27. A random variable X takes only two values, 0 and 1, with P(X = 0) = 0.6. Then the value of $E[X^6]$ is

A. 0.6
B. 0.6^6
C. 1
D. 0.4

1 mark

28. Given that in a Poisson distribution, the probability of observing 4 is 5/4 times that of observing 5, the mean of the distribution is

A. 3
B. 4
C. 5
D. None of the above

2 marks

29. Which of the following is not a discrete distribution?

A. Uniform
B. Binomial
C. Exponential
D. Poisson

1 mark

30. Given X is an exponential distribution and $p(X<6/p(X<8) = (1-e^{-0.5})/(1-e^{-2/3})$. What is the Var(x)?

A. 144
B. 12
C. 121

D. 11

2 marks

31. In how many of the distinct permutations of the letters in TENNESSEE do the four Es not come together?

A. 3780
B. 3200
C. 3600
D. 3720

2 marks

32. Determine the number of 4 card combinations out of a deck of 52 cards, if there is exactly one King and one spade in each combination.

A. 7,140
B. 22,680
C. 30,940
D. 29,820

2 marks

33. Determine the interquartile range for this set of numbers 1,1,2,3,5,8,13,21,34,55

A. 19
B. 21
C. 54
D. 27

1 mark

34. The correlation coefficient between X and Y is 0.5. Then the correlation coefficient between $3X$ and $-Y + 2$ is

A. 0.5
B. -0.5
C. 0.6
D. 0.4

1 mark

35. 3 cards were drawn at random from a deck of 52 cards. Given that all three of them have different symbols (spades/hearts/diamonds/clubs), what is the probability that all three cards are aces?

A. 1 in 14,134
B. 1 in 12,854
C. 1 in 13,182

D. 1 in 15,732

2 marks

36. Let X and Y be two events with $P(X) = 0.5$, $P(Y) = 0.8$ and $P(X \cap Y) = 0.4$. Then $P(X \cup Y)$ is

A. 0.5
B. 0.7
C. 0.8
D. 0.9

1 mark

37. Which graph is best suited to display the change of a variable over a period of time?

A. Boxplot
B. Bar graph
C. Line graph
D. Pie chart

1 mark

38. How many 3 digit numbers are there having at least one of their digits as 3?

A. 300
B. 252
C. 810
D. 312

1 mark

39. The number of permutations of the word 'ACTUARIES' is

A. 154,620
B. 90,720
C. 181,440
D. 362,880

1 mark

40. From a group of 12 boys and 8 girls, a team is to be formed such that there are 3 girls and 5 boys in the team. How many ways can this be one?

A. 12,320
B. 44,352
C. 125,970
D. 92,376

1 mark

Data Interpretation

There were 214 Indian and 119 foreign players in the recently concluded Indian Cricket League Auction. The number of players bought by each team are as shown in the table below. Answer questions 41- 44 based on your interpretation of the table.

Team	Indian		Foreign	
	Capped	Uncapped	Capped	Uncapped
Delhi	10	6	6	3
Mumbai	11	7	6	2
Kolkata	10	5	5	3
Chennai	12	5	6	2
Hyderabad	12	4	4	5
Bangalore	12	7	6	2
Ahmedabad	11	6	5	3
Jaipur	13	5	4	3

41. How many of the foreign players were unsold?

A. 78
B. 65
C. 54
D. 48

1 mark

42. Which team has maximum number of players?

A. Hyderabad
B. Mumbai
C. Chennai
D. Bangalore

1 mark

43. If 176 capped players were auctioned then, how many uncapped players went unsold?

A. 157
B. 89
C. 68
D. 43

1 mark

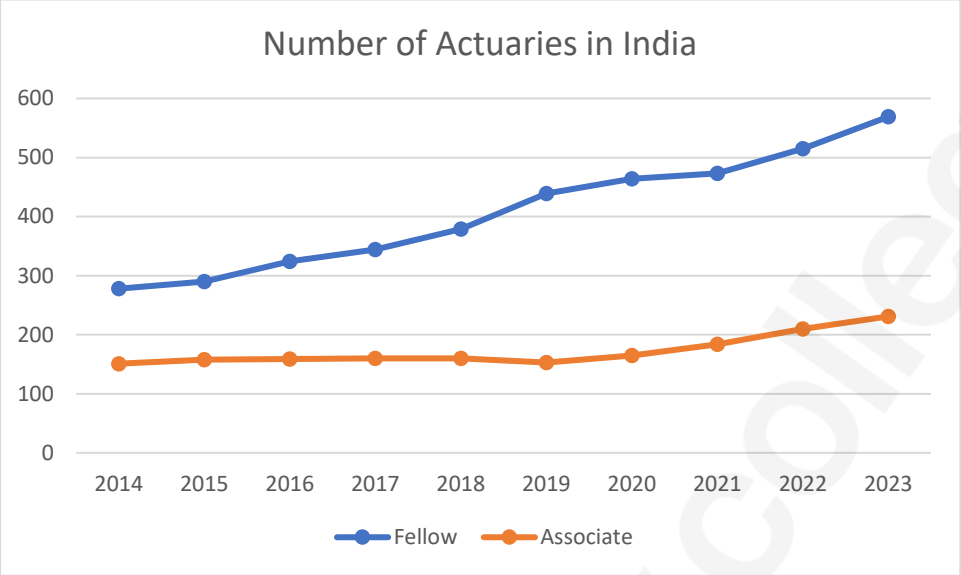
44. As above, if 176 capped players were auctioned then, at least how many foreign uncapped players were auctioned?

A. 23

B. 34
C. 44
D. 29

2 marks

Based on the data in the graph below answer the questions 45-48.



45. In which year the number of associate actuaries is lower compared to the previous year?

A. 2014
B. 2015
C. 2018
D. 2019

1 mark

46. How many fellow actuaries were present in 2022?

A. 515
B. 473
C. 499
D. 569

1 mark

47. In which year, was the increase in fellow actuaries (compared to previous year) maximum?

A. 2023
B. 2022
C. 2019
D. 2018

2 marks

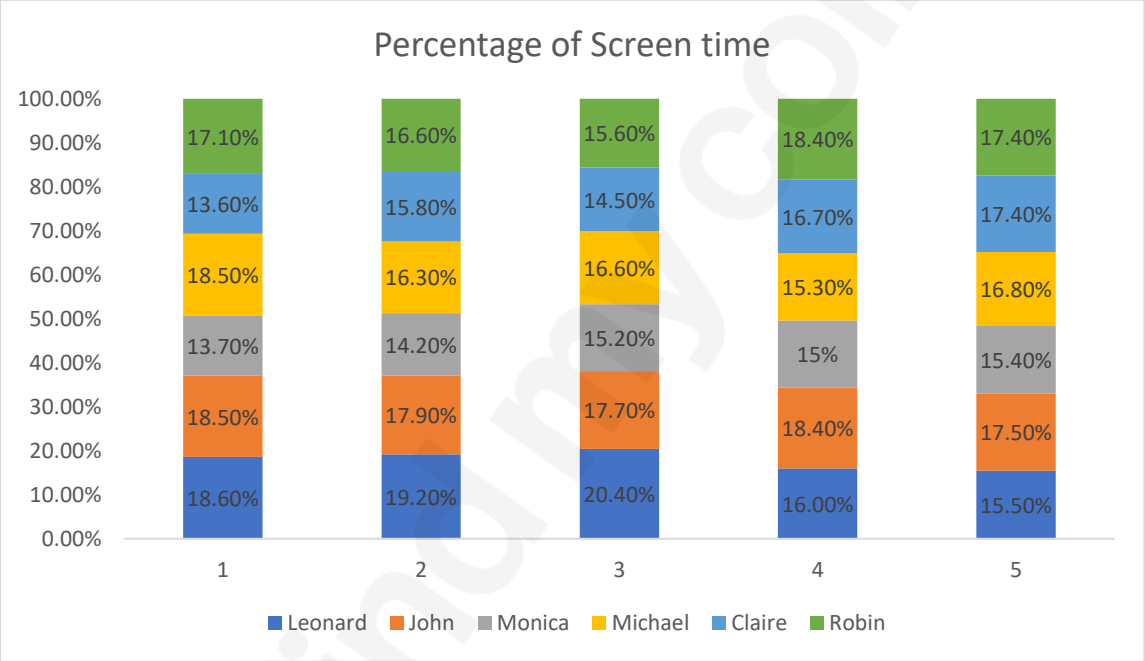
48. How many total number of actuaries (fellows and associates) were there in 2016?

A. 422
B. 510
C. 483
D. 450

1 mark

An analysis on the screen time of characters and the seasonal runtimes in a popular sitcom gave the below results. Assuming no overlap in screen time, answer questions 49-51 based on the graph.

Season	1	2	3	4	5
Runtime(hrs)	12.3	11.6	14.2	12.5	13.2



49. Which character had the maximum screen time across all seasons?

A. Leonard
B. John
C. Michael
D. Robin

2 marks

50. Which character had the minimum screen time across all seasons?

A. Monica
B. Claire
C. Robin
D. Michael

2 marks

51. Which character and season combination had the least screen time?

A. Monica, Season 1
B. Monica, Season 2
C. Claire, Season 1
D. Claire, Season 2

1 mark

52. Choose the correct form of verb to complete the sentence in the future continuous tense:

"By this time tomorrow, they ___ in Mumbai"

A. will relax
B. will be relaxing
C. relax
D. relaxing

1 mark

53. Choose the correct conjunction to complete the sentence:
"I will not go to the party ___ I am feeling unwell"

A. if
B. and
C. because
D. but

1 mark

54. Choose the synonym for the word "ubiquitous"

A. Rare
B. Abundant
C. Scarce
D. Limited

1 mark

55. Identify the correct definition for the word "ephemeral"

A. Lasting a long time
B. Permanent
C. Brief or short lived
D. Endless

1 mark

56. Choose the correct antonym for the word "vivid"

A. Dull
B. Bright
C. Colourful
D. Lively

1 mark

57. Choose the correct expansion for “”etc.” in the following sentence “The party decorations included balloons, streamers, confetti, etc.”

A. Exclusively
B. Extraordinary
C. Etymology
D. Et cetera

1 mark

58. Choose the correct expansion for “”viz.” in the following sentence “The committee members, viz., the president, treasurer, and secretary, attended the meeting.”

A. That is
B. For instance
C. Specifically
D. Such as

1 mark

59. Which phrase means "to gain knowledge or understanding of something previously unknown"?

A. Come across
B. Find out
C. Turn up
D. Look into

1 mark

60. Select the correct sentence:

A. The cat sits on the window sill, enjoying the warmth of the sun, and occasionally flicking its tail.
B. The cat sit on the window sill, enjoying the warmth of the sun, but occasionally flicking its tail.
C. The cat sits on the window sill, enjoying the warmth of the sun, but occasionally flicking its tail.
D. The cat sit on the window sill, enjoying the warmth of the sun, and occasionally flicking its tail.

2 marks

61. Select the correct sentence:

A. The dog chased the cat around the yard until they both got tired and fell asleep under the tree.
B. The dog chases the cats around the yard until they both got tired and fell asleep under the tree.

C. The dog chased the cat around the yard, but they managed to escape through the small hole in the fence.
D. The dog chase the cat around the yard, but the cat always manages to climb up the tree and escape

2 marks

Read the passage below and answer the question:

Nestled amidst the vibrant culture of Rajasthan, the Pink City of Jaipur stands as a beacon of history and heritage. Spread across an area of over 111 square kilometers, this majestic city offers a blend of architectural marvels, bustling markets, and cultural festivities. With its iconic pink-hued buildings, magnificent palaces, and intricate forts, Jaipur captivates visitors with its rich tapestry of tradition and modernity.

Jaipur is not just a city; it's a testament to Rajasthan's royal legacy and artistic prowess. Its landmarks, such as the Hawa Mahal and Amer Fort, have stood the test of time and continue to inspire awe among travellers and historians alike. Additionally, the city's vibrant bazaars, adorned with colorful textiles and traditional handicrafts, showcase Jaipur's vibrant artisanal culture.

Throughout the year, Jaipur plays host to a myriad of festivals and events, celebrating its rich heritage and cultural diversity. From the exuberant festivities of Diwali to the colorful spectacle of the Jaipur Literature Festival, the city pulsates with energy and enthusiasm. Families gather for leisurely strolls in the gardens, tourists explore the narrow alleys of the old city, and art enthusiasts marvel at the intricate designs adorning the city's temples and palaces.

Questions:

I. What distinguishes Jaipur as a unique destination in Rajasthan?
i. Its vibrant culture and rich heritage.
ii. Its sprawling area of over 111 square kilometers.
iii. Its location amidst the desert landscape of Rajasthan.

II. Which of the following activities is NOT mentioned as a feature of Jaipur?
i. Exploring colorful bazaars.
ii. Attending cultural festivals.
iii. Skiing in the snow-capped mountains.

III. What role does Jaipur play in celebrating Rajasthan's cultural heritage?
i. Its collection of historical landmarks and forts.
ii. Its popularity as a destination for leisurely strolls and sightseeing.
iii. Its function as a centre for modern art and architecture.

62. The correct answers to I, II, and III are:

A. iii, ii, i, respectively.
B. ii, iii, i, respectively.
C. i, ii, iii, respectively.
D. i, iii, i, respectively.

3 marks

Logical Reasoning

63. Identify the closest match to Lion: Pride from the following choices:

    A. Dog: Pack
    B. Bird: Park
    C. Tiger: Strong
    D. Cow: Domestic

1 mark

64. In a certain code, WORLD is written as FNTQY. How is SATURN written in that code?

    A. BZVZNT
    B. OSVUBT
    C. PTWVTU
    D. PTWVCU

2 marks

65. An accurate clock shows 11 o'clock in the morning. Through how may degrees will the hour hand rotate when the clock shows 4 o'clock in the evening?

    A. 120°
    B. 150°
    C. 179°
    D. 180°

1 mark

Eight students - Alex, Beth, Chris, David, Emma, Fiona, George, and Hannah - are seated around a circular table. The following conditions apply:

- Alex and Beth are sitting together.
- Chris is sitting exactly two seats away from David.
- Emma is sitting between Fiona and George.
- Hannah is sitting next to David.
- George is not sitting next to Chris.

Answer questions 66-67 based on this information

66. Who is sitting opposite to Fiona?

    A. David
    B. Emma
    C. Hannah

D. Chris

1 mark

67. If David and Hannah exchanges their seats, who is between Chris and Hannah?

A. Fiona and Emma
B. George and David
C. Alex and Beth
D. Emma and George

2 marks

68. Introducing a girl, a boy said, "She is the daughter of the son of the father of my uncle." How is the girl related to the boy?

A. Sister
B. Aunt
C. Sister-in-Law
D. Daughter

1 mark

69. If 4th May 2024 is Saturday. What will be the day after day of 4th May 2424?

A. Sunday
B. Tuesday
C. Monday
D. Saturday

1 mark

70. What is the next number in this series: 256, 254, 250, 248, 244, ...?

A. 240
B. 242
C. 236
D. 238

1 mark

****