STATISTITCAL ASSISTANT AT THE OFFICE OF THE CHIEF ENGINEER, PHE

YEAR OF ADVT: 2019 DATE OF EXAM: 5-JUNE-2024

Booklet Serial No. 31017

DO NOT BREAK THE SEAL OF THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

SERIES : I

QUESTION BOOKLET

Subjects : General English, General Knowledge & Aptitude and Mathematics/Statistics/Economics

Full Marks : 300 **Time Allowed : 2½ Hours**

Read the following instructions carefully before you begin to answer the questions.

INSTRUCTIONS TO CANDIDATES

1. This Booklet contains **150 Questions** to be answered in a separate OMR Answer Sheet using Black Ballpoint Pen in the following three Parts :

Part—A : General English	**: 25 questions**
Part—B : General Knowledge & Aptitude	**: 25 questions**
Part—C : [Select any ONE subject from the following]	
Mathematics/Statistics/Economics	**: 100 questions**

2. **All** questions are compulsory.
3. You will be supplied the Answer Sheet separately by the Invigilator. You must complete the details of particulars asked for.
4. Answers must be shown by completely blackening the corresponding circles in the Answer Sheet against the relevant question number by Black Ballpoint Pen. OMR Answer Sheet without marking Series shall not be evaluated.

   Example :

   Suppose the following question is asked :

   The Capital of Meghalaya is

   (A) Guwahati
   (B) Kohima
   (C) Shillong
   (D) Delhi

   You will have four alternatives in the Answer Sheet for your response corresponding to each question of the Question Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Shillong, then the same should be marked on the Answer Sheet by blackening the relevant circle with a Black Ballpoint Pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.
5. Answer the questions as quickly and as carefully as you can. Some questions may be difficult and others easy. Do not spend too much time on any one question.
6. There will NOT be any negative marking for wrong answers.
7. The Answer Sheet must be handed over to the Invigilator before you leave the Examination Hall.
8. No Rough Work is to be done on the Answer Sheet. Space for Rough Work has been provided in the Question Booklet.

SEAL

PART—A : GENERAL ENGLISH

(*Marks* : 50)

Each question carries **2** marks

Directions **: Read the following passage and answer the questions by selecting the answer choice from the alternatives given. Mark the correct answer in your answer sheet.**

Once upon a time, a businessman named Ray Kroc discovered a restaurant owned by two brothers. The restaurant served just four things—hamburgers, French fries, milk shakes and coca cola. But it was clean and inexpensive, and the service was quick. Mr. Kroc liked it so much that he paid the brothers so that he could use their idea and their name—McDonald's.

Beef, big business and fast service were the ingredients when Mr. Kroc opened his first McDonald's in 1955. Four years later, there were 100 of them. Kroc knew Americans liked success. So he put signs saying how many millions of McDonald's hamburgers people had bought. In just four years, the number was one hundred million. Now there are more than 13000 McDonald's restaurants from Dallas to Paris and from Moscow to Beijing.

Anyone who wants to open a McDonald's must first work in one for a week. Then, they do a nine-month training programme, in the restaurants and at 'McDonald's Univserity' in Chicago. There they learn the McDonald's philosophy—quality control, service, cleanliness and cheap prices. McDonald's has strict rules, Hamburgers must be served before they are ten minutes old, and French fries, seven.

McDonald's has never stopped looking for new methods to attract customers, from drive-in windows to birthday parties. Chicken, fish, salad and, in some places, pizza are now on the menu. McDonald's in Holland even sells a vegetarian burger. Their international popularity shows they have found the recipe for success.

1. How did putting up signs of his success in America help Mr. Kroc?

(A) People could work in the outlets for a week

(B) Children would visit the outlets more

(C) People could apply for jobs, children would visit the outlets more

(D) Americans would be impressed with the success and buy more hamburgers

2. What made the restaurants more popular?

(A) The servers were kind

(B) It was clean and inexpensive

(C) It was owned by two brothers

(D) The ingredients used were genuine

3. What is McDonald's philosophy?

(A) Quality control, service, cleanliness and high prices

(B) Quality control, cleanliness and cheap prices

(C) Quality control, service, cleanliness and cheap prices

(D) Quality control, service and cheap prices

4. Who is McDonald's named after?

(A) Two brothers unrelated to Mr. Kroc

(B) Two brothers related to Mr. Kroc

(C) Mr. Kroc's two sons

(D) Mr. Kroc's two brothers

***Directions* : From the given underlined idioms, choose the best alternative which expresses the closest meaning of the idiom. Mark the correct answer in your answer sheet.**

5. It is challenging to reply at the spur-of-the-moment when questioned in an interview.

(A) difficult moment

(B) without delay

(C) great moment

(D) very slow

6. Rahul was at his wit's end to find that his sister has failed.

(A) perplexed

(B) clear up

(C) explain

(D) enlighten

7. All three brothers are at loggerheads because of the land dispute.

(A) in difficulty

(B) very happy together

(C) in conflict

(D) None of the above

Directions **: In the following questions, substitute each sentence with a single word from among the given alternatives. Mark the correct answer in your answer sheet.**

8. Someone having many skills

(A) projectile

(B) cyclostyle

(C) anglophile

(D) versatile

9. A person who studies stars, planets and other heavenly bodies

(A) astronomer

(B) raconteur

(C) flounder

(D) astrologer

10. A person who is killed because of their religious or other beliefs

(A) soldier

(B) revolutionary

(C) martyr

(D) patriot

Directions **: In the following questions, choose a word that is opposite in meaning to the given word from among the given alternatives. Mark the correct answer in your answer sheet.**

11. Protect

(A) secure

(B) neglect

(C) defend

(D) save

12. Discovered

(A) exposed

(B) concealed

(C) contended

(D) bare

13. Wide

(A) spacious

(B) huge

(C) narrow

(D) large

Directions **: In the following questions, choose a word that is most similar in meaning to the given word from among the given alternatives. Mark the correct answer in your answer sheet.**

14. Conceal

(A) harvest

(B) to explore

(C) clear

(D) obscure

15. Emancipate

(A) liberate

(B) to put in cage

(C) proud

(D) collect

16. Peril

(A) ordinary

(B) safety

(C) danger

(D) caution

Directions **: In the following questions, a sentence is given in Direct/Indirect speech. Out of the four alternatives suggested, choose the one which best expresses the same sentence in Direct/Indirect speech. Mark the correct answer in your answer sheet.**

17. Mona said to Banda, "Kerbor will leave for Kolkata tomorrow."

(A) Mona told Banda that Kerbor will leave for Kolkata tomorrow.

(B) Mona told Banda that Kerbor left for Kolkata the next day.

(C) Mona told Banda that Kerbor would be leaving for Kolkata tomorrow.

(D) Mona told Banda that Kerbor would leave for Kolkata the next day.

18. He said to her, "What a windy day!"

(A) He told her that it was a windy day.

(B) He exclaimed that it was a windy day.

(C) He exclaimed that it was a rather windy day.

(D) He exclaimed that it was a very windy day.

19. He told her, "I want to meet your family."

(A) He told her that he wants to meet her family.

(B) He told her that he wanted to meet her family.

(C) He told her that he wanted to meet their family.

(D) He told her that she wanted to meet her family.

Directions **: In the given questions below, there are jumbled up sentence parts. Rearrange these parts, which are labelled A, B, C, D and E to produce the correct sentence. Choose the correct sequence from the given set of alternatives. Mark the correct answer in your answer sheet.**

20. children (A) / the (B) / were (C) / the animals (D) / fascinated by (E)

(A) BACED

(B) CBAED

(C) EDCBA

(D) DCEBA

21. plays an (A) / upbringing (B) / role in (C) / important (D) / personal progress (E)

(A) EBACD

(B) BDACE

(C) DACEB

(D) BADCE

22. an (A) / him popular (B) / made (C) / unexpected (D) / victory (E)

(A) AECBD

(B) DCBAE

(C) ADECB

(D) CBADE

Directions **: In the following questions, some sentences have errors and some do not. The underlined words are the key words where you can identify whether the sentence is erroneous or not. From the given set of choices, choose the correct alternative for the identified errors. Where there is no error, choose the specified option (D). Mark the correct answer in your answer sheet.**

23. The white chairs in the sitting room is made of teak.

(A) have

(B) had

(C) are

(D) No errors

24. He was asking for my opinion for the film.

(A) opinion on

(B) opinion of

(C) opinion with

(D) No errors

25. He has the guts to rise to the occasion.

(A) rise from

(B) rise for

(C) rise at

(D) No errors

PART—B : GENERAL KNOWLEDGE & APTITUDE

(*Marks* : 50)

Each question carries **2** marks

26. Which of the following festivals is known as '100 drums' festival?

(A) Wangala festival

(B) Tokha festival

(C) Bonalu festival

(D) Lohri festival

27. The study of bird is known as

(A) petrology

(B) ornithology

(C) lepidopterology

(D) mycology

28. Under which Article that the Constitution of India is the RTE (Right to Education) implemented?

(A) Article 54

(B) Article 12

(C) Article 21

(D) Article 12(a)

29. The President of India made use of his 'veto' power only once in

(A) the PEPSU Appropriation Bill

(B) the Hindu Code Bill

(C) the Dowry Prohibition Bill

(D) the Indian Post Office (Amendment) Bill

30. The new regime of income tax was launched in

(A) 2021

(B) 2022

(C) 2020

(D) 2014

31. Which of the following agencies has recognized 'Namami Gange' as one of the top 10 world restoration flagship programmes aimed at reviving the natural world?

(A) The World Bank

(B) The United Nations

(C) The USAID

(D) Bill Gates Foundation

32. Which of the following calcium compounds is used as mild abrasive in toothpaste?

(A) CaO

(B) $Ca(OH)_2$

(C) $CaCO_3$

(D) $CaCl_2$

33. A homogeneous mixture contains two liquids. How are they separated?

(A) By condensation

(B) By evaporation

(C) By filtration

(D) By distillation

34. Naturally occurring heaviest element is

(A) aluminium

(B) iron

(C) silicon

(D) uranium

35. Which one of the following is an endocrine as well as exocrine gland?

(A) Pituitary

(B) Thyroid

(C) Pancreas

(D) Parathyroid

36. According to Sri Lankan chronicle, *Mahavamsa*, Mauryan Emperor converted to Buddhism by

(A) Moggaliputta

(B) Tivara

(C) Karuvaki

(D) Nigrodha

37. In the FIFA World Cup, 2022, third place was won by

(A) Brazil

(B) Croatia

(C) France

(D) Morocco

38. The last three letters of the domain name describe the type of

(A) organization

(B) connectivity

(C) server

(D) protocol

39. A racing car is designed to have broad base and low height such that its centre of gravity is

(A) very low

(B) in the middle

(C) raised

(D) outside the car

40. The title of the short story in Rajasthani language, which was awarded with the Sahitya Akademi Award, is

(A) *Bachpan ki Baat*

(B) *Bareek Baat*

(C) *Beti ki Vidai*

(D) *Navi to Maan*

41. Select the number, from among the given options that can replace the question mark (?) in the following series :

39, 53, 69, 87, ?

(A) 99

(B) 107

(C) 92

(D) 115

42. The average of eight consecutive odd numbers is 28. The sum of the smallest and largest number is

(A) 45

(B) 52

(C) 48

(D) 56

43. If $43m = 0 \cdot 086$, then the m has the value of

(A) 0·002

(B) 0·02

(C) 2

(D) 0·2

44. *A* can complete a work in 25 days and *B* can complete the same work in 20 days. They started work together but, *B* left after 4 days and *A* continues to work. In how many days will the entire work be completed?

(A) 25 days

(B) 20 days

(C) 28 days

(D) 22 days

45. A shopkeeper announces a discount of 48% and then by further discount of 15%. What is the final sale price (in ₹ to the nearest ₹) of a sofa costing ₹ 29,600 and what is the discount in ₹ ?

(A) ₹ 13,280, ₹ 16,517

(B) ₹ 13,083, ₹ 16,517

(C) ₹ 16,517, ₹ 13,083

(D) ₹ 16,517, ₹ 13,280

46. The owner of an electronic store charges his customer 11% more than the cost price. If a customer pays ₹ 1,33,200 for LED TV, then what was the original price of the LED TV?

(A) ₹ 1,20,000

(B) ₹ 1,14,500

(C) ₹ 1,22,500

(D) ₹ 1,18,000

47. The sum of 55% of a number and 40% of the same number is 180·5. What is 80% of the number?

(A) 134

(B) 152

(C) 148

(D) 166

48. The average age of a class is 15·8 years. The average age of the boys in the class is 16·4 years, while that of the girls is 15·4 years. What is the ratio of the boys to the girls in the class?

(A) 1 : 2

(B) 3 : 4

(C) 3 : 5

(D) None of the above

49. What would be the compound interest obtained on an account of ₹ 7,640 at the rate of 15 p.c.p.a. after two years?

(A) ₹ 2,364·9

(B) ₹ 2,643·9

(C) ₹ 2,634·9

(D) ₹ 2,463·9

50. An aeroplane covers a certain distance @ the speed of 240 km/hr in 5 hours. To cover the same distance in $1\frac{2}{3}$ hours, it must travel @ a speed in km/hr of

(A) 300

(B) 360

(C) 600

(D) 720

PART—C

(*Marks* : 200)

[Select any ONE subject from the following]

MATHEMATICS

Each question carries **2** marks

51. Which of the following is ***not*** true about $\mathbb{Q}$, the set of rationals?

(A) Ordered field

(B) Countable

(C) Infinite

(D) Uncountable

52. In terms of modulus notation, $-7 \leq x \leq -3$ is same as

(A) $|x+5| \leq -2$

(B) $|x+5| \leq 2$

(C) $|x+5| \geq 2$

(D) $|x+5| \geq -2$

53. The solution of $|3-2x| < 1$ is

(A) (1, 2)

(B) (−1, 2)

(C) (−2, 1)

(D) (−2, 2)

54. If $y = \sinh^{-1} x$, then $\frac{dy}{dx}$ is

(A) $\frac{1}{\sqrt{1-x^2}}$

(B) $\frac{1}{\sqrt{x^2-1}}$

(C) $\frac{1}{\sqrt{x^2+1}}$

(D) None of the above

55. Which of the following is true?

(A) $\cosh^2 x - \sinh^2 x = 1$

(B) $\sinh^2 x - \cosh^2 x = 1$

(C) $\operatorname{sech}^2 x - \tanh^2 x = 1$

(D) $\tanh^2 x - \operatorname{sech}^2 x = 1$

56. The function $f(x) = \sin x$ is a periodic function of period

(A) 2π

(B) π

(C) $\frac{\pi}{2}$

(D) None of the above

57. If $f(x) = \log x$, then which of the following is ***not*** true?

(A) $f(x) + f(y) = f(xy)$

(B) $f(x) - f(y) = f\left(\frac{x}{y}\right)$

(C) $f(x^n) = nf(x)$

(D) $f(x)$ is strictly decreasing

58. The domain of $f(x) = \sqrt{\log\left(\frac{5x - x^2}{4}\right)}$ is

(A) [0, 5]

(B) [0, 5)

(C) (0, 5]

(D) (0, 5)

59. The function $f(x) = \log(x + \sqrt{1 + x^2})$ is

(A) odd function

(B) even function

(C) periodic function

(D) constant function

60. If $f(x) = \frac{|x|}{x}$ and $c \neq 0$ be any real number, then $|f(c) - f(-c)|$ is

(A) 0

(B) 2

(C) undefined

(D) None of the above

61. The limit $\lim_{n \to \infty} \sqrt{n+1} - \sqrt{n}$

(A) diverges

(B) converges to 0

(C) oscillates between 0 and 1

(D) None of the above

62. The value of $\lim_{x \to \infty} \frac{2x^2 + x + 1}{x^2 - 3x + 1}$ is

(A) 0

(B) 1

(C) 2

(D) None of the above

63. The value of $\lim_{x \to 0} \frac{(1+x)^{1/2} - 1}{(1+x)^{1/3} - 1}$ is

(A) ∞

(B) 1

(C) 2

(D) $\frac{3}{2}$

64. If $f(x) = -\sqrt{16 - x^2}$, then $\lim_{x \to 1} \frac{f(x) - f(1)}{x - 1}$ is

(A) $-\sqrt{15}$

(B) $\sqrt{15}$

(C) $\frac{1}{\sqrt{15}}$

(D) $-\frac{1}{\sqrt{15}}$

65. The function

$$f(x) = \begin{cases} 5, & x < 0 \\ 7, & x = 0 \\ 8, & x > 0 \end{cases}$$

at $x = 0$ suffers

(A) removable discontinuity

(B) simple but not removable discontinuity

(C) jump discontinuity

(D) a discontinuity of second kind

66. Which of the following is ***not*** true?

(A) $f(x) = x^2$ is continuous at every point

(B) $f(x) = x^2$ is uniformly continuous over $\mathbb{R}$

(C) $f(x) = x^2$ is increasing

(D) $f(x) = x^2$ is even function

67. The derivative of $\tan x$ with respect of $\sin x$ is

(A) $\sec^3 x$

(B) $\cos^3 x$

(C) $\sin^3 x$

(D) $\tan^3 x$

68. If $y = x^3$ and x is increasing at the rate of 10 units per minute, then how fast y is changing when $x = 3$?

(A) 90 units/minute

(B) 180 units/minute

(C) 270 units/minute

(D) None of the above

69. Using differentials, the approximate value of $\sqrt{51}$ is

(A) 7·14

(B) 7·2

(C) 7·21

(D) 7·44

70. The equation of the tangent to the curve $y = ae^{bx}$ at $x = 0$ is

(A) $y = ax + b$

(B) $y = bx + a$

(C) $y = abx + a$

(D) $y = abx + b$

71. The value of $\int_0^{\pi/4} \tan^2 \theta \, d\theta$ is

(A) $\frac{\pi}{4}$

(B) $1 + \frac{\pi}{4}$

(C) $1 - \frac{\pi}{4}$

(D) 1

72. The value of $\int_e^{e^2} \frac{dx}{x \log x}$ is

(A) $\log 2$

(B) $2 \log 2$

(C) $\log \frac{1}{2}$

(D) $\frac{1}{2} \log 2$

73. The value of $\int e^x \frac{1 + \sin x}{1 + \cos x} dx$ is

(A) $e^x \cot \frac{x}{2}$

(B) $-e^x \cot \frac{x}{2}$

(C) $e^x \tan \frac{x}{2}$

(D) $-e^x \tan \frac{x}{2}$

74. The value of $\int_0^{\pi/2} \frac{dx}{3+5\sin x}$ is

(A) $4\log 3$

(B) $\frac{1}{4}\log 3$

(C) $4\log\left(\frac{1}{3}\right)$

(D) $\frac{1}{4}\log\left(\frac{1}{3}\right)$

75. The value of $\int_0^{\pi/2} \cos^6 x\,dx$ is

(A) $\frac{5\pi}{32}$

(B) $\frac{5}{32}$

(C) $\frac{5\pi}{16}$

(D) $\frac{\pi}{16}$

76. The differential equation

$$\frac{d^2y}{dx^2} = x^3\left(\frac{dy}{dx}\right)^2$$

is of

(A) second order, first degree

(B) second order, second degree

(C) first order, second degree

(D) first order, first degree

77. $\frac{d^2y}{dx^2} = 0$ is a differential equation of

(A) straight line

(B) parabola

(C) circle

(D) any curve

78. The differential equation of the curve $y = Ae^{2x} + Be^{-2x}$ is

(A) $\frac{d^2y}{dx^2} = 4y$

(B) $\frac{d^2y}{dx^2} + 4y = 0$

(C) $\frac{d^2y}{dx^2} = 4x$

(D) $\frac{d^2y}{dx^2} + 4x = 0$

79. If $\frac{dv}{dt} = \frac{-v^2}{100}$, $v = 15$ when $t = 10$, then what is the value of t when $v = 10$?

(A) 3

(B) $\frac{7}{3}$

(C) $\frac{40}{3}$

(D) 4

80. The integrating factor of

$$y^2 + \left(x - \frac{1}{y}\right)\frac{dy}{dx} = 0$$

is

(A) $e^{1/y}$

(B) $e^{-1/y}$

(C) e^x

(D) $e^{-1/x}$

81. The points $A(2\hat{i}-\hat{j}+\hat{k})$, $B(\hat{i}-3\hat{j}-5\hat{k})$ and $C(3\hat{i}-4\hat{j}-4\hat{k})$ are the vertices of

(A) equilateral triangle

(B) isosceles triangle

(C) right-angled triangle

(D) None of the above

82. If $A(\hat{i}+3\hat{j}-7\hat{k})$ and $B(5\hat{i}-2\hat{j}+4\hat{k})$, then the direction cosines of $\overrightarrow{AB}$ are

(A) $\frac{4}{9\sqrt{2}}, \frac{5}{9\sqrt{2}}, \frac{11}{9\sqrt{2}}$

(B) $\frac{4}{9\sqrt{2}}, \frac{-5}{9\sqrt{2}}, \frac{11}{9\sqrt{2}}$

(C) $\frac{4}{9\sqrt{2}}, \frac{5}{9\sqrt{2}}, \frac{-11}{9\sqrt{2}}$

(D) $\frac{-4}{9\sqrt{2}}, \frac{5}{9\sqrt{2}}, \frac{11}{9\sqrt{2}}$

83. The length of the diagonals of a unit cube is

(A) $2\sqrt{3}$

(B) $3\sqrt{3}$

(C) $\sqrt{3}$

(D) $\frac{1}{\sqrt{3}}$

84. The angle between the vectors $2\hat{i}+2\hat{j}-\hat{k}$ and $3\hat{i}-2\hat{j}-\hat{k}$ is

(A) $\cos\theta = \frac{1}{14}$

(B) $\cos\theta = \frac{1}{\sqrt{14}}$

(C) $\sin\theta = \frac{1}{14}$

(D) $\sin\theta = \frac{1}{\sqrt{14}}$

85. In a ΔABC with $AB = 8$, $BC = 7$ and $CA = 6$, then

(A) $\cos A = \frac{17}{32}$

(B) $\cos A = \frac{1}{4}$

(C) $\cos A = \frac{11}{16}$

(D) None of the above

86. The area of a triangle formed by $A(1, 1, 1)$, $B(1, 2, 3)$ and $C(2, 3, 1)$ is

(A) $\sqrt{21}$

(B) $\frac{\sqrt{21}}{2}$

(C) $\frac{\sqrt{21}}{3}$

(D) $\frac{\sqrt{21}}{5}$

87. The length of the vector $(3\hat{i}+4\hat{j})\times(\hat{i}-\hat{j}+\hat{k})$ is

(A) $\sqrt{71}$

(B) $\sqrt{72}$

(C) $\sqrt{73}$

(D) $\sqrt{74}$

88. If $\vec{a}$ is a unit vector, then

(A) direction of $\vec{a}$ is constant

(B) magnitude of $\vec{a}$ is constant

(C) direction and magnitude of $\vec{a}$ are constant

(D) None of the above

89. If $\vec{a}$, $\vec{b}$, $\vec{c}$ be the position vectors of the points A, B and C respectively, then $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{AC}$ is

(A) $\vec{0}$

(B) $2(\vec{b}-\vec{a})$

(C) $2(\vec{c}-\vec{a})$

(D) $\vec{a}+\vec{b}+\vec{c}$

90. The projection of the vector $2\hat{i}+3\hat{j}-2\hat{k}$ on the vector $\hat{i}-2\hat{j}+3\hat{k}$ is

(A) $\frac{2}{\sqrt{14}}$

(B) $\frac{1}{\sqrt{14}}$

(C) $\frac{3}{\sqrt{14}}$

(D) $\frac{4}{\sqrt{14}}$

91. The value of $[\vec{a}+\vec{b},\ \vec{b}+\vec{c},\ \vec{c}+\vec{a}]$ is

(A) $[\vec{a},\ \vec{b},\ \vec{c}]$

(B) $2[\vec{a},\ \vec{b},\ \vec{c}]$

(C) $|\vec{a}||\vec{b}||\vec{c}|$

(D) 0

92. The value of

$$\{|\vec{a}\times\vec{b}|^2+(\vec{a}\cdot\vec{b})^2\}\div a^2b^2$$

is

(A) 0

(B) 1

(C) 2

(D) None of the above

93. The necessary and sufficient condition for a vector $\vec{v}(t)$ to have a constant direction is

(A) $\vec{v}\cdot\frac{d\vec{v}}{dt}=0$

(B) $\vec{v}\times\frac{d\vec{v}}{dt}=0$

(C) $\vec{v}=0$

(D) $\frac{d\vec{v}}{dt}=0$

94. If $\frac{d\vec{a}}{dt} = \lambda\vec{b}$ and $\frac{d\vec{b}}{dt} = \mu\vec{a}$, then the value of $\frac{d}{dt}(\vec{a} \times \vec{b})$ is

(A) $\lambda\mu(\vec{a} \times \vec{b})$

(B) $\lambda\mu(\vec{b} \times \vec{a})$

(C) $\frac{\lambda}{\mu}(\vec{a} \times \vec{b})$

(D) $\vec{0}$

95. The value of div $\hat{r}$ is

(A) $\frac{1}{r}$

(B) $\frac{2}{r}$

(C) $-\frac{1}{r}$

(D) $\frac{1}{r^2}$

96. The time period of a particle executing SHM is

(A) $\frac{2\pi}{\sqrt{\mu}}$

(B) $\frac{2\pi}{\mu}$

(C) 2π

(D) $2\pi\mu$

97. The escape velocity of a projectile from the earth is approximately

(A) 101 km/s

(B) 7 km/s

(C) 11·2 km/s

(D) 112 km/s

98. The transverse component of acceleration is

(A) $\frac{d}{dt}(r^2\dot{\theta})$

(B) $\frac{1}{r}\frac{d}{dt}(r^2\dot{\theta})$

(C) $\frac{d}{dt}(r^2\theta)$

(D) $\frac{1}{r}\frac{d}{dt}(r^2\theta)$

99. If a particle with initial velocity u is projected upward in a direction inclined at an angle 60° to the horizontal, then the velocity at its greatest height is

(A) u

(B) $2u$

(C) $\frac{u}{2}$

(D) $\frac{\sqrt{3}u}{2}$

100. Which of the following is Keplar's third law?

(A) $T^2 \propto a^3$

(B) $T^2 \propto \frac{1}{a^3}$

(C) $T^3 \propto a^2$

(D) $T^3 \propto \frac{1}{a^2}$

101. The resultant of two equal forces P at angle α is

(A) $2P\cos\alpha$

(B) $2P\cos^2\alpha$

(C) $2P\cos 2\alpha$

(D) $2P\cos\frac{\alpha}{2}$

102. Two forces acting at a point have got their resultant 10 when acting at right angle, and their least resultant is 2. Then their greatest resultant is

(A) 14

(B) 15

(C) 18

(D) 21

103. The minimum value of the function

$$f(x) = x^2 - x + 2$$

is

(A) $\frac{1}{2}$

(B) $\frac{3}{4}$

(C) $\frac{7}{4}$

(D) $\frac{1}{4}$

104. Two equal and unlike parallel forces, whose lines of action are not the same, form

(A) an equilibrium

(B) a couple

(C) a single resultant

(D) None of the above

105. If three forces acting on a rigid body be in equilibrium, then they must automatically be

(A) mutually perpendicular

(B) non-coplanar

(C) coplanar

(D) parallel to each other

106. The area of the quadrilateral, whose angular points taken in order are $(a, 0)$, $(-b, 0)$, $(0, a)$, $(0, -b)$, is

(A) ab

(B) $\frac{1}{2}ab$

(C) $2ab$

(D) None of the above

107. The polar form of the Cartesian equation $x^2 - y^2 = a^2$ is

(A) $r\cos\theta = a$

(B) $r^2\cos^2\theta = a^2$

(C) $r^2\cos 2\theta = a^2$

(D) None of the above

108. The locus of point which moves so that that the sum of the squares of its distances from $(1, 0)$ and $(-1, 0)$ is equal to 10, is

(A) $x^2 - y^2 = 4$

(B) $x^2 + y^2 = 4$

(C) $x^2 + y^2 + 2x + 5 = 0$

(D) None of the above

109. Two lines $y = mx + c$ and $y = m'x + c'$ are perpendicular, if

(A) $m = m'$

(B) $mm' = 1$

(C) $mm' = -1$

(D) $m + m' = 1$

110. The angle between the lines $y = 3x$ and $y + 5x = 0$ is

(A) $\tan^{-1}\left(\frac{4}{7}\right)$

(B) $\tan^{-1}\left(-\frac{4}{7}\right)$

(C) $\tan^{-1}(28)$

(D) $\tan^{-1}(-28)$

111. The locus of the point given by parametric coordinate $(t - 1,\ t + 1)$ is

(A) $x + y = 2$

(B) $-x + y = 2$

(C) $x - y = 2$

(D) $x + y = -2$

112. By transforming to parallel axes through the new origin $(2, -1)$, the equation $5x + 3y = 3$ is

(A) $5x + 3y = -4$

(B) $5x + 3y = 4$

(C) $5x + 3y = 10$

(D) $5x + 3y = -10$

113. The angle between the pair of straight lines given by the equation

$$3x^2 + 10xy + 8y^2 + 16x + 26y + 21 = 0$$

is

(A) $\tan\theta = \frac{2}{11}$

(B) $\tan\theta = \frac{11}{2}$

(C) $\tan\theta = \frac{-2}{11}$

(D) $\tan\theta = \frac{-11}{2}$

114. The line $y = mx + c$ is a tangent to the circle $x^2 + y^2 = a^2$ if

(A) $c = \pm\sqrt{1 + a^2m^2}$

(B) $c = \pm a\sqrt{1 + m^2}$

(C) $c = \pm a(1 + m^2)$

(D) None of the above

115. The radius of the circle $3x^2 + 3y^2 - 5x - 6y + 4 = 0$ is

(A) $\sqrt{6}$

(B) $\sqrt{13}$

(C) $\sqrt{\frac{6}{13}}$

(D) $\frac{\sqrt{13}}{6}$

116. The direction cosines of X-axis are

(A) [1, 0, 0]

(B) [0, 1, 0]

(C) [0, 0, 1]

(D) [1, 1, 1]

117. If O is the origin, $P(2, 3, 4)$ and $Q(1, k, 1)$ be two points such that $OP \perp OQ$, then $k = ?$

(A) 0

(B) 2

(C) -2

(D) No such k exists

118. The intercepts made on the axes by the plane $x + 2y - 2z = 9$ are

(A) 1, 2, -2

(B) $\frac{1}{9}, \frac{2}{9}, -\frac{2}{9}$

(C) $9, \frac{9}{2}, \frac{9}{2}$

(D) $9, \frac{9}{2}, -\frac{9}{2}$

119. The angle between the two planes $3x - 4y + 5z = 0$ and $2x - y - 2z = 5$ is

(A) $\frac{\pi}{3}$

(B) $\frac{\pi}{2}$

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{4}$

120. The equation of the plane through the origin and parallel to the plane $3x - 4y + 5z - 6 = 0$ is

(A) $3x - 4y + 5z + 6 = 0$

(B) $3x + 4y - 5z + 6 = 0$

(C) $3x - 4y + 5z - 6 = 0$

(D) $3x - 4y + 5z = 0$

121. Any point on the line

$$\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$$

is given by

(A) (α, β, γ)

(B) $(l\alpha, m\beta, n\gamma)$

(C) $(\alpha + l\gamma, \beta + m\gamma, \gamma + n\gamma)$

(D) None of the above

122. The equation of the X-axis is

(A) $\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$

(B) $\frac{x}{1} = \frac{y}{0} = \frac{z}{1}$

(C) $\frac{x}{1} = \frac{y}{1} = \frac{z}{0}$

(D) $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$

123. The lines

$$\frac{x}{1} = \frac{y}{2} = \frac{z}{3} \text{ and } \frac{x-1}{-2} = \frac{y-2}{-4} = \frac{z-3}{-6}$$

are

(A) parallel

(B) intersecting

(C) skew

(D) perpendicular

124. The centre of the sphere

$$x^2 + y^2 + z^2 - 4x + 6y - 8z + 8 = 0$$

is

(A) (2, 3, 4)

(B) (–2, 3, 4)

(C) (2, – 3, 4)

(D) (–2, – 3, – 4)

125. The equation

$$x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$$

represents a sphere if $u^2 + v^2 + w^2 - d$ is

(A) zero or negative

(B) negative

(C) zero

(D) positive

126. Which of the following sets is finite?

(A) $A = \{x | x^2 = 16\}$

(B) $B = \{x | 1 \leq x \leq 100\}$

(C) $C = \{x | x$ is an integer$\}$

(D) $D = \{x | x$ is a star in the sky$\}$

127. If A and B are two sets, then $A \cap (A \cup B)$ is

(A) A

(B) B

(C) ϕ

(D) None of the above

128. In the set of real numbers, the relation 'greater than' is

(A) reflexive

(B) symmetric

(C) transitive

(D) None of the above

129. A relation ρ is defined on the set of real numbers as $x \rho y \Leftrightarrow 2x + 3y = 4$. Which of the following is true?

(A) $0 \rho 1$

(B) $\frac{2}{3} \rho 1$

(C) $\frac{4}{3} \rho 0$

(D) $1 \rho \left(\frac{2}{3}\right)$

130. Let $f : \mathbb{R} \to \mathbb{R}$ defined by $f(x) = 3x - 4$. Then f^{-1} is

(A) $3x + 4$

(B) $\frac{1}{3}x - 4$

(C) $\frac{1}{3}(x + 4)$

(D) None of the above

131. The set of integers under subtraction is ***not*** a group because it is not

(A) closed

(B) associative

(C) commutative

(D) Existence of inverse

132. The set $\{1, 2, 3\}$ is ***not*** a group under multiplication modulo 4 because

(A) it is not closed

(B) no identity exists

(C) 2 has no inverse

(D) None of the above

133. Which of the following is ***not*** an Abelian group?

(A) $(\mathbb{Z}, +)$

(B) $(M(2, \mathbb{R}), +)$

(C) $(\mathbb{R}^n, +)$

(D) $(SL(2, \mathbb{R}), \times)$

134. In $(\mathbb{Z}_{12}, +)$ if $a = 4$, then the order of a is

(A) 1

(B) 3

(C) 4

(D) 12

135. Let a be a group element whose order is 15. What is the order of a^3?

(A) 12

(B) 8

(C) 6

(D) 5

136. The value of $(a + \omega b)(a + \omega^2 b)$, where $\omega^3 = 1$, is

(A) $a^2 + ab + b^2$

(B) $a^2 - ab + b^2$

(C) $a^2 + \omega ab + b^2$

(D) $a^2 + \omega^2 ab + b^2$

137. If $a, b, c, d \in \mathbb{R}$, then what is the condition that $(a + ib)(c + id) \in \mathbb{R}$?

(A) $ab + cd = 0$

(B) $ac + bd = 0$

(C) $a^2 + b^2 = 0$

(D) None of the above

138. In De Moivre's form, $1+i$ is equal to

(A) $\sqrt{2}\left(\cos\frac{\pi}{2}+i\sin\frac{\pi}{2}\right)$

(B) $\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{2}\right)$

(C) $\sqrt{2}\left(\cos\left(-\frac{\pi}{2}\right)+i\sin\frac{\pi}{4}\right)$

(D) $\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$

139. $\cos\left(\frac{2k\pi+\pi}{3}\right)+i\sin\left(\frac{2k\pi+\pi}{3}\right)$, $k = 0, 1, 2,$ is the cube root of

(A) 1

(B) $1+i$

(C) $1-i$

(D) -1

140. The remainder when

$$4x^4+7x^3-3x^2+5x-1$$

is divided by $x-2$, is

(A) 115

(B) 117

(C) 119

(D) None of the above

141. If $x^3+3px+q$ has a factor of the form $(x-a)^2$, then

(A) $q^2+4p^3=0$

(B) $q^2-4p^3=0$

(C) $q^3+4p^2=0$

(D) $q^3-4p^2=0$

142. If 3 is one of the roots of the equation

$$x^3+3x^2-10x-24=0$$

then all the roots are

(A) 3, 2, 4

(B) 3, –2, 4

(C) 3, 2, –4

(D) 3, –2, –4

143. The least number of imaginary roots of the equation $x^7+6x^4-7x+k=0$ is

(A) 4

(B) 3

(C) 2

(D) 1

144. If the equation $x^4-14x^2-24x-k=0$ has four real and unequal roots, then which of the following is true?

(A) $2<k<6$

(B) $4<k<8$

(C) $8<k<11$

(D) $11<k<15$

145. Two of its roots of the equation $x^3 - 5x^2 - 4x + 20 = 0$ are equal and opposite, then all its roots are

(A) $\pm 5, 2$

(B) $\pm 5, 3$

(C) $5, \pm 2$

(D) $5, \pm 3$

146. If the roots of the equation $x^3 - 15x^2 + 66x - 80 = 0$ are in AP, then all its roots are

(A) 2, 4, 6

(B) 2, 5, 8

(C) 2, 6, 10

(D) 2, 7, 12

147. If α, β, γ be the roots of the equation $x^3 - x^2 + 12x + 5 = 0$, then the value of $\alpha^2 + \beta^2 + \gamma^2$ is

(A) -10

(B) -11

(C) -12

(D) -13

148. The value of the determinant

$$\begin{vmatrix} a & b & 0 \\ 0 & a & b \\ b & 0 & a \end{vmatrix}$$

is

(A) $a^2 + b^2$

(B) $a^2 + b^3$

(C) $a^3 + b^2$

(D) $a^3 + b^3$

149. Matrix scalar multiplication obeys

(A) associative law

(B) commutative law

(C) distributive law

(D) All of the above

150. A square matrix A is said to be orthogonal, if

(A) $A^{-1}A = I$

(B) $A = A^{-1}$

(C) $A^T A = I$

(D) $A = A^T$

STATISTICS

Each question carries **2** marks

51. Which of the following is correct regarding statistics?

(A) Aggregate of facts

(B) Numerically expressed

(C) Affected by multiplicity of causes

(D) All of the above

52. In singular sense statistics means

(A) statistical science

(B) statistical law

(C) Both (A) and (B)

(D) Neither (A) nor (B)

53. Which of the following indicates a stage of statistical study?

(A) Collection of data

(B) Presentation of data

(C) Analysis of data

(D) All of the above

54. In descriptive statistics, we study

(A) the description of decision-making process

(B) the methods of organizing, displaying and describing data

(C) how to describe probability distributions

(D) None of the above

55. Reports on quality control, production and financial accounts issued by companies are considered as

(A) external secondary data sources

(B) internal secondary data sources

(C) external primary data sources

(D) internal primary data sources

56. Secondary data are

(A) unimportant data

(B) ordinary data

(C) existing data

(D) ordinal data

57. Secondary data are least helpful to

(A) formulate hypotheses

(B) develop questionnaires

(C) evaluate new products

(D) interpret tables

58. Under inclusive method

(A) the upper class limit of a class is excluded in the class interval

(B) both upper and lower class limits are excluded

(C) the lower class limit of a class is excluded

(D) None of the above

59. The 'less than' and 'more than' ogives are types of

(A) class distribution

(B) cumulative class distribution

(C) cumulative frequency distribution

(D) None of the above

60. Class frequency is divided by total number of observations in a frequency distribution to convert it into

(A) relative margin distribution

(B) relative variable distribution

(C) relative frequency distribution

(D) cumulative frequency distribution

61. The sum of frequencies for all classes will always equal to

(A) 1

(B) a value between 0 and 1

(C) the number of elements in the data set

(D) the number of classes

62. In constructing a frequency distribution, as the number of classes decreases, the class width

(A) decreases

(B) increases

(C) remains unchanged

(D) can increase or decrease depending on data values

63. In a cumulative frequency distribution, the last class will always have a cumulative frequency equal to

(A) one

(B) 100

(C) total number of elements in the data set

(D) None of the above

64. Which of the following is the title of rows of a table?

(A) Title

(B) Stub

(C) Caption

(D) None of the above

65. If the values in a series are very large and the difference between the smallest value and zero is high, then we use _____ base line.

(A) original

(B) false

(C) true

(D) None of the above

66. In a histogram the area of each rectangle is proportional to

(A) the class mark of the corresponding class interval

(B) the class size of the corresponding class interval

(C) frequency of the corresponding class interval

(D) cumulative frequency of the corresponding class interval

67. Which of the following can be determined from an ogive?

(A) Mean

(B) Median

(C) Mode

(D) Geometric mean

68. The sample mean is

(A) always equal to the population mean

(B) never equal to the population mean

(C) a statistic

(D) a parameter

69. The median of a set of numbers 5, 5, 12, 15, 18, 11, 7 and 9 is

(A) 4

(B) 33/2

(C) 41

(D) 10

70. The central value of a set of 240 values can be obtained by

(A) 3rd quartile

(B) 2nd quartile

(C) 4th quartile

(D) 100th percentile

71. The most frequently occurring value in a data is

(A) Mean

(B) Median

(C) Mode

(D) Geometric Mean

72. The mode value of the set 3, 5, 7, 9 and 11 is

(A) 0

(B) 11

(C) 5

(D) None of the above

73. The GM of the numbers 8, 4, 2 is

(A) 8

(B) 4

(C) 7

(D) 14/3

74. Which of the following is ***not*** a measure of central tendency?

(A) Geometric Mean

(B) Mean Deviation

(C) Mode

(D) P_{50}

75. Median is preferred to mean when

(A) population is large enough

(B) low variance is seen

(C) skewed distribution is seen

(D) None of the above

76. If the top-most score in a distribution is tripled, which measure will change?

(A) Mean

(B) Median

(C) Mode

(D) None of the above

77. Which of the following can take two values for a given distribution?

(A) Mean

(B) Median

(C) Mode

(D) None of the above

78. If the mean and median value of a grouped data are 16 and 30 respectively, then the mode value is

(A) 18

(B) 58

(C) 0

(D) 92

79. The measure of dispersion which is more useful in case of open-end distributions is

(A) Range

(B) Mean deviation

(C) Standard deviation

(D) Quartile deviation

80. Mean deviation is

(A) less than standard deviation

(B) more than standard deviation

(C) equal to standard deviation

(D) not related to standard deviation

81. Which of the following is least affected by extreme items?

(A) Quartile deviation

(B) Standard deviation

(C) Mean deviation

(D) Range

82. Which one is ***not*** a measure of dispersion?

(A) Quartile deviation

(B) Mean deviation

(C) Inter-quartile range

(D) Skewness

83. 20 babies are born in a hospital on the same day. Each weighs 2·5 kg, the standard deviation is

(A) 1

(B) 0

(C) 2·5

(D) 5

84. In a series of 300 boys, the mean systolic blood pressure was 120 mm of Hg and the standard deviation was found to be 20. The coefficient of variation is

(A) 16·7%

(B) 8·3%

(C) 40%

(D) 30%

85. Dispersion of a grouped data can be graphically represented by

(A) normal curve

(B) Lorenz curve

(C) cumulative frequency curve

(D) None of the above

86. If one score in a distribution is changed to another value, it is certain that

(A) the range has changed

(B) the quartile deviation has changed

(C) the standard deviation has changed

(D) the question does not make sense

87. The general formula for an estimate of the variance is the sum of squared deviations divided by

(A) population size

(B) sample size

(C) degrees of freedom

(D) level of significance

88. If $r = 1 \cdot 02$, what does it indicate?

(A) Strong +ve correlation

(B) Weak +ve correlation

(C) Moderate +ve correlation

(D) The value is wrong

89. If the correlation between rainy days and sales per week is very strong, what will be the possible value of correlation coefficient?

(A) 0·1

(B) −0·1

(C) 0·9

(D) −0·9

90. If $\sum d_i^2 = 0$, the value of rank correlation ρ is (where d_i is the difference between two ranks of each observation)

(A) 0

(B) +1

(C) 2

(D) −1

91. The unit of correlation coefficient between height in feet and weight in kg is

(A) kg/feet

(B) feet/kg

(C) in percentage

(D) non-existent

92. Among the following measures, which can measure any type (linear and non-linear) of relationship?

(A) Karl Pearson's coefficient of correlation

(B) Spearman's coefficient of rank correlation

(C) Scatter diagram

(D) Both (A) and (B) are correct

93. An association between variables can be known by calculating

(A) coefficient of correlation

(B) coefficient of association

(C) coefficient of variation

(D) None of the above

94. Mean of 400 observations is 100 and standard deviation is 8, then what will be the standard error of mean?

(A) 0·4

(B) 1·0

(C) 0·1

(D) 4·0

95. Which of the following is ***not*** true about SRS?

(A) Technique provides least number of possible samples

(B) Every fixed unit is taken for selection

(C) Only selected units have the right to be chosen

(D) All of the above

96. The standard error of prediction is a kind of

(A) Median

(B) Mean

(C) Standard deviation

(D) Mean deviation

97. For a survey, a village is divided into 5 lanes, then each lane is sampled randomly, this is an example of

(A) simple random sampling

(B) cluster sampling

(C) stratified sampling

(D) multistage sampling

98. A selection of every unit from a normally distributed population is utilizing

(A) simple random sampling

(B) cluster sampling

(C) complete enumeration

(D) systematic sampling

99. In cluster sampling

(A) every *n*th case is chosen for study

(B) it involves the use of random numbers

(C) a natural group is taken as sampling unit

(D) stratification of population is done

100. Interviewing hockey players as they exit the arena is an example of what type of sampling?

(A) Quota

(B) Convenience

(C) Simple random

(D) Cluster

101. A sampling frame is

(A) a summary of the various stages involved in designing a survey

(B) an outline view of all the main clusters in a sample

(C) a list of all the units in the population from which a sample will be selected

(D) None of the above

102. Which of the following would lead to the smallest confidence interval?

(A) Small sample size and confidence coefficient of 0·95

(B) Large sample size and confidence coefficient of 0·95

(C) Small sample size and confidence coefficient of 0·90

(D) Large sample size and confidence coefficient of 0·90

103. An important difference between judgemental and statistical sampling is that in statistical sampling

(A) no judgement is required as formula is available for everything

(B) efficiency is better

(C) population estimate with reliability of estimate can be obtained

(D) All of the above

104. If population size $N = 54000$ and sample size $n = 6000$, following the systematic sampling approach, if 4th unit is selected as the first unit in the sample, then the next unit to be selected in the sample would be

(A) 8th

(B) 10th

(C) 13th

(D) 12th

105. If two regression lines are given as

$$y = a + bx$$
$$x = c + dy$$

then the correlation coefficient between x and y is

(A) $\sqrt{bd}$

(B) $\sqrt{cb}$

(C) $\sqrt{ad}$

(D) $\sqrt{ac}$

106. If a constant 60 is subtracted from each of the values of x and y, then the regression coefficient is

(A) reduced by 60

(B) increased by 60

(C) 1/60 of the original

(D) not changed

107. For a bivariate data set on (x, y), if the means, standard deviations and correlation coefficient are $\bar{x} = 1{\cdot}0$, $\bar{y} = 2{\cdot}0$, $s_x = 3{\cdot}0$, $s_y = 9{\cdot}0$, $r = 0{\cdot}8$, then the regression line of y on x is

(A) $y = 1 + 2{\cdot}4(x - 1)$

(B) $y = 2 + 0{\cdot}27(x - 1)$

(C) $y = 2 + 2{\cdot}4(x - 1)$

(D) $y = 1 + 0{\cdot}27(x - 2)$

108. What is the skewness of a normal distribution?

(A) 0

(B) 1

(C) -1

(D) 2

109. Which of the following is ***incorrect*** if E and F are independent?

(A) $P(E \cap F) = P(E) \cdot P(F)$

(B) $P(F|E) = P(F)$, $P(E) \neq 0$

(C) $P(E|F) = P(E)$, $P(F) \neq 0$

(D) $P(F|E) = P(F)$, where $P(E)$, $P(F) \neq 0$

110. If μ be the rth order central moment of a population, then μ_0, μ_1, μ_2 are

(A) 0, 1, σ^2

(B) 1, 0, σ^2

(C) 1, 1, σ^2

(D) 1, 0, σ

111. A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random from the bag. What is the probability that all of them are red?

(A) $\frac{2}{91}$

(B) $\frac{3}{22}$

(C) $\frac{1}{22}$

(D) $\frac{2}{77}$

112. A, B and C are three mutually exclusive and exhaustive events. $P(A) = 2P(B) = 6P(C)$. Find $P(B)$.

(A) 0·1

(B) 0·3

(C) 0·6

(D) 0·4

113. If the distribution is negatively skewed, then the

(A) mean is more than the mode

(B) median is at the right of the mode

(C) mean is less than the mode

(D) None of the above

114. Find the expectation of a random variable x from the following table :

x	0	1	2	3
$f(x)$	$\frac{1}{6}$	$\frac{2}{6}$	$\frac{2}{6}$	$\frac{1}{6}$

(A) 1

(B) 2

(C) 1·5

(D) 2·5

115. Two coins are tossed simultaneously. The probability of appearing two heads simultaneously is

(A) $\frac{1}{8}$

(B) $\frac{1}{6}$

(C) $\frac{1}{4}$

(D) $\frac{1}{2}$

116. A sample of underweight babies was fed a special diet and the following weight gains (lbs) were observed at the end of three months :

6·7, 2·7, 2·5, 3·6, 3·4, 4·1, 4·8, 5·9, 8·3

The mean and standard deviation are

(A) 4·58, 3·82

(B) 3·82, 4·67

(C) 4·67, 1·95

(D) 1·95, 4·67

117. An urn contains 30 tickets numbered 1 to 30. Two tickets are drawn at random. The probability that both the numbers are prime is

(A) $\frac{{}^{8}C_{2}}{{}^{30}C_{2}}$

(B) $\frac{{}^{9}C_{2}}{{}^{30}C_{2}}$

(C) $\frac{{}^{10}C_{2}}{{}^{30}C_{2}}$

(D) $\frac{{}^{11}C_{2}}{{}^{30}C_{2}}$

118. Suppose A and B are two independent events with $P(A) = 0{\cdot}2$ and $P(B) = 0{\cdot}4$. Then $P(A$ and not $B)$ is

(A) 0·12

(B) 0·60

(C) 0·08

(D) 0·52

119. A simple experimental design with two levels of an independent variable ***cannot***

(A) detect a curvilinear relationship between variables

(B) detect a monotonic relationship

(C) reveal a positive relationship

(D) show a negative relationship outcome

120. What are the factors in a factorial design?

(A) Independent variables

(B) Dependent variables

(C) Experimental variables

(D) All of the above

121. In a 3×3 factorial design, how many conditions are there in the experiment?

(A) 2

(B) 3

(C) 6

(D) 9

122. Student's t-test is applicable only when

(A) $n \leq 30$ and σ is known

(B) $n = 30$ and σ is known

(C) $n > 30$ and σ is unknown

(D) All of the above

123. The _____ sum of squares measures the variability of the observed values around their respective treatment means.

(A) treatment

(B) error

(C) interaction

(D) total

124. What must be included when reporting an ANOVA?

(A) Standard deviations, degrees of freedom, means, F-statistic, P-value

(B) Standard deviations, means, F-statistic, P-value

(C) Standard deviations, degrees of freedom, means, F-statistic

(D) Degrees of freedom, F-statistic, P-value

125. As variability due to chance decreases, the value of F will

(A) increase

(B) stay the same

(C) decrease

(D) Cannot tell from the given information

126. Two factors are said to be orthogonal when

(A) they are correlated, i.e., cannot vary independently

(B) there are equal number of participants in all groups

(C) they are uncorrelated, i.e., vary independently

(D) there is a single control group, with which all the other groups can be compared

127. You have carried out a Kruskal-Wallis test. There are significant differences between the three groups you are testing. How might you conduct your pairwise comparisons?

(A) Use the Mann-Whitney test

(B) Use the Wilcoxon test

(C) Use a t-test

(D) None of the above

128. In factorial designs, the number of times a condition is noted is called

(A) Randomization

(B) Factorization

(C) Replication

(D) None of the above

129. In testing of hypothesis, a Type–II error occurs when

(A) the null hypothesis is not rejected when the null hypothesis is true

(B) the null hypothesis is rejected when it is true

(C) the null hypothesis is not rejected when the alternative hypothesis is true

(D) the null hypothesis is rejected when the alternative hypothesis is true

130. Why do we perform experiments in a random order?

(A) To enhance the factor interactions

(B) To minimize the effect of unknown variables

(C) To separate the main effects from interaction

(D) To maximize the effect of unknown variables

131. How many runs does a full-factorial 4-factor 3-level experiment consist of?

(A) 64

(B) 81

(C) 124

(D) 16

132. The Latin Square design allows for _____ blocking factors.

(A) one

(B) two

(C) three

(D) None of the above

133. Which term is having a closest meaning as sampling distributions?

(A) Control charts

(B) On site inspection

(C) Whole lot inspection

(D) Acceptance sampling

134. Process capability generally uses

(A) specifications

(B) control limits

(C) process standard deviation

(D) mean of any one sample

135. A tolerance diagram is also called

(A) scatter diagram

(B) defect concentration diagram

(C) histogram

(D) tier chart

136. What type of chart will be used to plot the number of defectives in the output of any process?

(A) $\bar{X}$-chart

(B) R-chart

(C) c-chart

(D) p-chart

137. Slope of OC curve for $\bar{X}$-chart will _____ when sample size is increased.

(A) decrease

(B) increase

(C) remain same

(D) decrease then increase

138. The control charts based directly on the sample variance are called

(A) s-control charts

(B) σ^2-control charts

(C) s^2-control charts

(D) $\bar{X}$-charts

139. Consider a Poisson distribution for the tossing of a biased coin. The mean for this distribution is μ. The standard deviation for this distribution is given by

(A) $\sqrt{\mu}$

(B) μ^2

(C) μ

(D) $\frac{1}{\mu}$

140. Standard normal distribution has which of the following properties?

(A) Mean = Variance = 1

(B) Mean = 0, Variance = 1

(C) Mean = Standard deviation

(D) Variance = 0

141. Approximately what area is covered under the normal distribution curve between ±3 standard deviation?

(A) 80%

(B) 88·60%

(C) 99·73%

(D) 68·00%

142. In a Poisson distribution, if n is the number of trials and p is the probability of success, then the mean value is given by

(A) np

(B) $(np)^2$

(C) $np(1-p)$

(D) p

143. The Poisson distribution is applied for

(A) continuous random variable

(B) discrete random variable

(C) irregular random variable

(D) uncertain random variable

144. For a Poisson distribution, if mean $(m) = 1$, then $P(1)$ is

(A) $\frac{1}{e}$

(B) e

(C) $\frac{e}{2}$

(D) Cannot be determined

145. If p, q and n are probability of success, failure and number of trials respectively in a Binomial distribution, then what is its standard deviation?

(A) $\sqrt{np}$

(B) $\sqrt{pq}$

(C) $(np)^2$

(D) $\sqrt{npq}$

146. It is suitable to use Binomial distribution for

(A) large values of n

(B) small values of n

(C) fractional values of n

(D) any value of n

147. In a Binomial distribution, if $p = q$, then $P(X)$ is given by

(A) ${}^nC_x(0\cdot5)^n$

(B) ${}^nC_x\, p^{(n-x)}$

(C) ${}^nC_n(0\cdot5)^n$

(D) ${}^nC_n\, p^{(n-x)}$

148. Vital statistics throws light on

(A) growth of population

(B) fertility of races

(C) changing pattern of the population during intercensal period

(D) All of the above

149. The registration of vital statistics in India suffers from

(A) incomplete reporting

(B) incomplete coverage

(C) lack of accuracy

(D) All of the above

150. The simplest measure of fertility, requiring only total births and total population is

(A) SBR

(B) CBR

(C) GFR

(D) NRR

ECONOMICS

Each question carries **2** marks

51. An autonomous increase in expenditure should result in an increase in a country's real GNP if only

(A) the country's balance of trade is negative

(B) the country's economy is working under the conditions of less than full employment

(C) it is government expenditure

(D) the multiplier is at least 1·5

52. A systematic record of all economic transactions completed between residents of a country and rest of the world in a year is known as

(A) net capital flow

(B) balance of payments

(C) balance of trade

(D) absolute flow

53. Which among the following imposes a greater burden (relative to resources) on the poor than on the rich?

(A) Progressive tax

(B) Regressive tax

(C) Lump-sum tax

(D) Proportionate tax

54. If a commodity has more number of substitutes, the demand for this commodity will be

(A) more elastic

(B) less elastic

(C) inelastic

(D) perfectly elastic

55. Which among the following is used for a situation of 'too much money chasing too few goods'?

(A) Demand-pull inflation

(B) Cost-pull inflation

(C) Stagflation

(D) Hyperinflation

56. A monopolist will be able to maximise his profit when

(A) his output is maximum

(B) he charges a higher price

(C) his average cost is minimum

(D) his marginal cost is equal to marginal revenue

57. Economic growth is normally coupled with

(A) inflation

(B) hyperinflation

(C) deflation

(D) stagflation

58. A transfer payment is a payment that is

(A) made by the Government to its current workers

(B) made to the people who are needy

(C) for in-kind services provided to the Government

(D) for which no services or goods are rendered

59. Which of the following is ***not*** added in the calculation of national income of India?

(A) The value of goods and services

(B) The sold value of the old fridge

(C) The services rendered by the housewives

(D) Both (B) and (C)

60. Which of the following is related to microeconomics?

(A) The size of the national economy

(B) Inflation

(C) Unemployment

(D) Behaviour of individual economic unit

61. 'Gresham's law' in economics relates to which of the following?

(A) Supply and demand

(B) Circulation of currency

(C) Consumption and supply

(D) Distribution of goods and services

62. Which of the following is the fixed cost of a firm?

(A) Land

(B) Labour

(C) Both (A) and (B)

(D) None of the above

63. Which of the following currently defines the economic profit?

(A) Total revenue – Total cost

(B) Total cost – Total sold

(C) Total cost – Total revenue

(D) None of the above

64. What is the extra cost imposed by the Government which increases the price for a consumer?

(A) Subsidy

(B) Tax

(C) Inflation

(D) Fine

65. Which type of economy is Indian economy?

(A) Mixed

(B) Market

(C) Capitalist

(D) Socialist

66. Which among the following is a part of macroeconomics?

(A) Investment of households

(B) Wages of a person

(C) How to produce goods

(D) Aggregate economic activity

67. Which of the following is a part of national income?

(A) Value of all goods and services produced in a financial year

(B) A reused good sold in the financial year

(C) Service rendered by housewife

(D) None of the above

68. What does free market in an economy imply?

(A) Minimum government intervention in trade and maximum regulations

(B) Maximum government intervention in trade and maximum regulations

(C) Minimum government intervention in trade and minimum regulations

(D) Maximum government intervention in trade and minimum regulations

69. Which of the following is included in market price?

(A) Indirect tax

(B) Direct tax

(C) Subsidy

(D) None of the above

70. Which term is used to describe the want satisfying power of a commodity or a service?

(A) Demand

(B) Want

(C) Utility

(D) Consumption

71. The main objective of minimum support prices is

(A) to check fall in price beyond a limit

(B) to protect interest of the consumers

(C) to make procurement from the wholesalers easy

(D) None of the above

72. Which of the following types of economy has purely private ownership?

(A) Socialist economy

(B) Capitalist economy

(C) Mixed economy

(D) Traditional economy

73. Which country is the largest rice exporter in the world?

(A) India

(B) Thailand

(C) Vietnam

(D) China

74. When was the Tea Act passed?

(A) 1955

(B) 1954

(C) 1965

(D) 1960

75. What is the contribution of textile industry to the export earning for India?

(A) 15%

(B) 20%

(C) 25%

(D) 10%

76. What is the minimum term for a certificate of deposit of banks issued by scheduled commercial banks?

(A) 15 days

(B) 14 days

(C) 1 month

(D) 3 months

77. Which among the following is a type of transport infrastructure?

(A) Highways

(B) Railways

(C) Canals

(D) All of the above

78. Who is the first Indian Governor of the Reserve Bank of India?

(A) C. D. Deshmukh

(B) Sachindra Roy

(C) S. Mukherjee

(D) None of them

79. Who governs the money supply?

(A) Planning Commission

(B) Finance Commission

(C) Reserve Bank of India

(D) Commercial Banks

80. Which of the following Five-Year Plans recognised human development as the core of all developmental endeavours?

(A) First Five-Year Plan

(B) Second Five-Year Plan

(C) Eighth Five-Year Plan

(D) Ninth Five-Year Plan

81. In order to maximise profits, a monopoly company will produce that quantity at which the

(A) marginal revenue equals average total cost

(B) price equals marginal revenue

(C) marginal revenue equals marginal cost

(D) total revenue equals total cost

82. Which of the following best defines price discrimination?

(A) Charging different prices on the basis of race

(B) Charging different prices for goods with different costs of production

(C) Charging different prices based on cost of service differences

(D) Selling a certain product of given quality and cost per unit at different prices to different buyers

83. Who propounded the opportunity cost theory of international trade?

(A) Ricardo

(B) Marshall

(C) Heckscher and Ohlin

(D) Haberler

84. An individual demand curve slopes downward to the right because of the

(A) working of the law of diminishing marginal utility

(B) substitution effect of decrease in price

(C) income effect of the fall in price

(D) All of the above

85. Income elasticity of demand is defined as the responsiveness of

(A) quantity demanded to a change in income

(B) quantity demanded to a change in price

(C) price to a change in income

(D) income to a change in quantity demanded

86. The supply of a good refers to

(A) stock available for sale

(B) total stock in the warehouse

(C) actual production of a good

(D) quantity of a good offered for sale at a particular price per unit of time

87. The cost of one thing in terms of the alternative given up is called

(A) real cost

(B) production cost

(C) physical cost

(D) opportunity cost

88. The economist's objection to monopoly rests on which of the following grounds?

(A) There is a transfer of income from consumers to the monopolist

(B) There is welfare loss as resources tend to be misallocated under monopoly

(C) Both (A) and (B) are incorrect

(D) Both (A) and (B) are correct

89. In which of the following market structures, the degree of control over the price of its product by a firm is very large?

(A) Imperfect competition

(B) Perfect competition

(C) Monopoly

(D) Both (A) and (B)

90. The offer curves introduced by Alfred Marshall, helps us to understand how the _____ is/are established in international trade.

(A) terms of trade

(B) equilibrium price ratio

(C) exchange rate

(D) satisfaction level

91. Demand for factor of production is

(A) derived demand

(B) joint demand

(C) composite demand

(D) None of the above

92. The producer's demand for a factor of production is governed by which of the following factors?

(A) Price which will decrease

(B) Marginal productivity

(C) Availability

(D) Profitability

93. Which statistical measure helps in measuring the purchasing power of money?

(A) Arithmetic average

(B) Index number

(C) Harmonic mean

(D) Time series

94. Which among the following statements is ***incorrect***?

(A) Welfare economics is based on value judgements.

(B) Welfare economics is also called 'economics with heart'.

(C) Welfare economics focuses on questions about equity as well as efficiency.

(D) The founder of welfare economics was Alfred Marshall.

95. Who is the 'lender of the last resort' in the banking structure of India?

(A) State Bank of India

(B) Reserve Bank of India

(C) EXIM Bank of India

(D) Union Bank of India

96. _____ is the official minimum rate at which the Central Bank of a country is prepared to rediscount approved bills held by the commercial banks.

(A) Repo rate

(B) Bank rate

(C) Prime lending rate

(D) Reverse repo rate

97. In order to control credit, Reserve Bank of India should

(A) increase CRR and decrease bank rate

(B) decrease CRR and reduce bank rate

(C) increase CRR and increase bank rate

(D) reduce CRR and increase bank rate

98. Which among the following is a function of Reserve Bank of India?

(A) Bank issues the letters of credit to their customers certifying their credibility

(B) Collecting and compilation of statistical information relating to banking and other financial sector

(C) Bank underwrites the securities issued by public or private organization

(D) Accepting deposits from the public

99. Number of times a unit of money changes hands in the course of a year is called

(A) supply of money

(B) purchasing power of money

(C) velocity of money

(D) value of money

100. What is meant by autarky in international trade?

(A) Monopoly in international trade

(B) Imposition of restrictions in international trade

(C) Removal of all restrictions from international trade

(D) The idea of self-sufficiency and no international trade by a country

101. Normally a demand curve will have the _____ shape.

(A) horizontal

(B) vertical

(C) downward sloping

(D) upward sloping

102. Who defined economics as a science which studies human behaviour as a relationship between ends and scarce means which have alternative uses?

(A) L. Robbins

(B) Alfred Marshall

(C) Joan Robinson

(D) Paul A. Samuelson

103. Law of demand shows the relation between

(A) income and price of commodity

(B) price and quantity of commodity

(C) income and quantity demanded

(D) quantity demanded and quantity supplied

104. A mixed economy is characterised by the co-existence of

(A) modern and traditional industries

(B) public and private sectors

(C) foreign and domestic investments

(D) commercial and subsistence farming

105. Which of the following is ***not*** a feature of iso-product curves?

(A) Downward sloping to the right

(B) Shows different input combinations producing the same output

(C) Intersects each other

(D) Convex to the origin

106. Some economists refer to iso-product curve as

(A) Engel's curve

(B) production indifference curve

(C) budget line

(D) ridge line

107. According to Joseph Schumpeter, profit is the reward for

(A) innovation

(B) uncertainty bearing

(C) risk-taking

(D) management

108. If quantity demanded is completely unresponsive to changes in price, demand is

(A) inelastic

(B) unit elastic

(C) elastic

(D) perfectly inelastic

109. Which of the following is micro-economics concerned with?

(A) The size of national output

(B) The level of employment

(C) The changes in general level of prices

(D) None of the above

110. Other things being equal, if a good has many substitutes, its price elasticity of demand is

(A) larger

(B) smaller

(C) zero

(D) unity

111. The price of a product falls by 10% and its demand rises by 30%. The elasticity of demand is

(A) 10%

(B) 30%

(C) 3%

(D) 1%

112. An increase in the supply of a commodity is caused by

(A) improvements in technology

(B) fall in the prices of other commodities

(C) fall in the prices of factor of production

(D) All of the above

113. Which of the following is one of the assumptions of perfect competition?

(A) Consists of few buyers and few sellers

(B) Consists of many buyers and few sellers

(C) Consists of many buyers and many sellers

(D) All sellers and buyers are honest

114. Price and demand are positively correlated in case of

(A) normal goods

(B) comforts

(C) Giffen goods

(D) luxuries

115. In which form, the largest percentage of national income is earned?

(A) Employee's wages

(B) Interest income

(C) Proprietor's income

(D) None of the above

116. A firm under perfect competition is

(A) price maker

(B) price breaker

(C) price taker

(D) price shaker

117. Total utility is maximum when

(A) marginal utility is zero

(B) marginal utility is at its highest point

(C) marginal utility is equal to average

(D) average utility is maximum

118. Which is a condition for existence of monopoly?

(A) Big size

(B) Identical product

(C) Absence of government taxes

(D) No close substitute

119. The situation of monopolistic competition is created by

(A) the small number of producers of a commodity

(B) the lack of homogeneity of the product produced by different firms

(C) the imperfection of the market for that product

(D) All of the above

120. Demand is a function of

(A) price

(B) quantity

(C) supply

(D) None of the above

121. The major difference between perfect competition and monopolistic competition is

(A) number of firms

(B) differentiated product

(C) rate of profit

(D) free entry and exit

122. Which is ***not*** an assumption of the theory of demand based on the analysis of indifference curve?

(A) Given scale of preference as between different combinations of two goods

(B) Diminishing marginal rate of substitution

(C) Constant marginal utility of money

(D) Consumers would always prefer more of a particular good to less of it other things remaining the same

123. What does price elasticity of demand measure?

(A) Change in price caused by changes in demand

(B) The rate of change of sales

(C) The responsiveness of demand to price changes

(D) The value of sales at a given price

124. When marginal revenue is zero, total revenue is

(A) maximum

(B) minimum

(C) zero

(D) decreasing

125. Which one is the increasing function of price?

(A) Demand

(B) Utility

(C) Supply

(D) Consumption

126. Which one of the following oligopoly models is concerned with the maximization of joint profits?

(A) Price leadership model

(B) Bertrand's model

(C) Collusive model

(D) Edgeworth's model

127. A firm decides to exit the industry when

(A) AC starts rising

(B) MC starts rising

(C) price is less than LAC

(D) TC starts rising

128. In the context of oligopoly, the kinked demand curve hypothesis is designed to explain

(A) price and output determination

(B) price rigidity

(C) price leadership

(D) collusion among rivals

129. The revealed preference theory deduces the inverse price-quantity relationship from

(A) assumption of indifference

(B) postulate of utility maximization

(C) observed behaviour of the consumer

(D) introspection

130. Which form of market structure is characterised by interdependence in decision-making as between the different competing firms?

(A) Oligopoly

(B) Perfect competition

(C) Imperfect competition

(D) None of the above

131. If price changes by 1% and supply changes by 2%, then supply is

(A) elastic

(B) inelastic

(C) indeterminate

(D) static

132. An ISO-product curve slopes

(A) downward to the left

(B) downward to the right

(C) upward to the left

(D) upward to the right

133. Which of the following is ***not*** the assumption of the marginal productivity theory of distribution?

(A) Homogeneity of a factor

(B) Perfect competition in the factor market

(C) All factors, except one, are variable

(D) Given stock of each factor and full employment

134. Normal profit is called normal because

(A) it is neither very high nor very low

(B) it is minimum acceptable to the producer

(C) it is the minimum which buyer wants to pay

(D) it is the maximum allowed by the government

135. Supply curve is

(A) vertical in the long-run

(B) flatter in the long-run

(C) same in the long- and short-run

(D) horizontal in both short- and long-run

136. A vertical supply curve, parallel to the price axis, implies that the elasticity of supply is

(A) zero

(B) infinity

(C) equal to one

(D) greater than zero but less than infinity

137. With which of the following theories of wages, is the name of John Stuart Mill associated?

(A) Marginal productivity theory of wages

(B) Wages-fund theory

(C) Subsistence theory of wages

(D) Iron law of wages

138. If a firm shuts down temporarily, it will incur the loss equal to

(A) AFC

(B) AVC

(C) TFC

(D) TVC

139. During a particular year, farmers experienced a dry weather. If all the other factors remain constant, farmers supply curve for wheat will shift

(A) rightward

(B) leftward

(C) upward

(D) None of the above

140. Economic rent can accrue to

(A) land only

(B) capital only

(C) specialized technical personnel only

(D) any of the factors of production

141. A firm should shut down in the short run if it is not covering its

(A) variable cost

(B) fixed cost

(C) total cost

(D) explicit cost

142. Economic problems arise because

(A) wants are unlimited

(B) resources are scarce

(C) scarce resources have alternative uses

(D) All of the above

143. Identify the author of *On the Principles of Political Economy and Taxation.*

(A) Alfred Marshall

(B) J. S. Mill

(C) David Ricardo

(D) A. Turgot

144. Which is ***not*** a central problem of an economy?

(A) What to produce

(B) How to produce

(C) How to maximize private profit

(D) For whom to produce

145. A significant property of the Cobb-Douglas production function is that the elasticity of substitution between inputs is

(A) equal to 1

(B) more than 1

(C) less than 1

(D) 0

146. Who is generally regarded as the founder of the 'classical school'?

(A) David Ricardo

(B) Adam Smith

(C) T. R. Malthus

(D) J. S. Mill

147. Union leaders are in better position to bargain for higher wages if demand for labour is

(A) elastic

(B) inelastic

(C) very large

(D) permanent

148. Economies of scale are of which two kinds?

(A) Temporary and permanent

(B) Internal and external

(C) Managerial and industrial

(D) Natural and artificial

149. Identify the economist who had little formal education and started working in the money market at an early age of fourteen.

(A) David Ricardo

(B) Adam Smith

(C) V. F. D. Pareto

(D) A. A. Cournot

150. Golden revolution in India is related to which of the following?

(A) Precious metals

(B) Pulses

(C) Horticulture and honey

(D) Production of jewellery