

DO NOT BREAK THE SEAL OF THE BOOKLET UNTIL YOU ARE TOLD TO DO SO**QUESTION BOOKLET****SERIES III****Subjects : General English, General Knowledge & Aptitude, Mathematics/Economics/Statistics****BOOKLET SERIAL NO. 170355****Marks : 300****Time : 2½ hours**

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

INSTRUCTIONS TO CANDIDATES

1. This booklet contains **175 questions** to be answered in a separate OMR Answer Sheet using Black Ball Pen in following three parts:
Part-A-General English : 50 questions, Part-B-General Knowledge & Aptitude : 25 questions, Part-C-Mathematics OR Economics OR Statistics : 100 questions
2. All Questions are compulsory. **Part C is optional. Candidates has to opt either Mathematics OR Economics OR Statistics.**
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 Ball Pen. OMR Answer Sheet without marking series/ double series marking shall not be evaluated.

Example :

Supposing 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 :-

(A) (B) (C) (D)

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 Ball Point Pen only as below :-

(A) (B) (C) (D)

WHICH 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.



PART-A-GENERAL ENGLISH

Marks :50

Each question carry 1 mark :

SECTION-I

Directions : In the following passage some of the words have been left out. Read the passage, understand it and then fill in the blanks with the help of the alternatives given.

Education is not an end but a 1 to an end. We do not 2 children only for the 3 of educating them ; we want to 4 them for life. We cannot continue with the old 5 of education without 6 it. It has become 7 to think that free education can 8 all the problems of 9 and build a perfect 10.

- | | |
|-------------------|----------------|
| 1. a) tool | b) means |
| c) way | d) path |
| 2. a) educate | b) learn |
| c) teach | d) guide |
| 3. a) end | b) dream |
| c) purpose | d) goal |
| 4. a) push | b) nudge |
| c) run | d) prepare |
| 5. a) drama | b) baggage |
| c) system | d) dream |
| 6. a) criticising | b) rejecting |
| c) dismissing | d) examining |
| 7. a) stylish | b) fashionable |
| c) hopeless | d) demanding |
| 8. a) solve | b) terminate |
| c) resume | d) divide |
| 9. a) family | b) business |
| c) teachers | d) society |
| 10. a) house | b) building |
| c) classroom | d) nation |

SECTION-II

Directions : Choose the correct option to fill in the gaps :

11. _____ the weather was warm, I took off my coat.
a) because b) as
c) whereas d) although
12. I was astonished _____ what I saw.
a) at b) about
c) over d) on
13. I am the best player _____ ?
a) can't I b) will I
c) shall I d) aren't I
14. It is no use crying _____.
a) of spilt milk b) about spilt milk
c) over spilt milk d) on spilt milk
15. The President _____ here next week.
a) will arrive b) could not arrive
c) arrived d) has arrived
16. He is _____ of hearing.
a) long b) short
c) shot d) difficult
17. It is _____ that I shall get the prize.
a) declared b) hoped
c) rejected d) dismissed
18. I was shocked _____ his behaviour.
a) at b) in
c) into d) from
19. He has been asked to _____ a low profile.
a) put up b) build
c) make d) keep
20. The two candidates are running _____ in the elections.
a) hand in hand
b) neck and neck
c) foot to mouth
d) fingers apart

21. If you cheat him, you will fall _____ into trouble.

- a) low b) down
- c) deep d) below

22. Crime is _____ the rise.

- a) by b) on
- c) in d) under

23. He was _____ his patience

- a) in the middle of b) at the start of
- c) at the beginning of d) at the end of

24. He occasionally _____ to ask if I had any problems.

- a) dropped out b) dropped back
- c) dropped up d) dropped in

25. _____ a place it is !

- a) what b) how
- c) where d) before

26. I do not need any more food. This is more than _____.

- a) less b) much
- c) sufficient d) few

27. _____ ! my cat is dead.

- a) Hurrah b) Bravo
- c) Alas d) Nonsense

28. You have to send _____ the doctor.

- a) in b) by
- c) of d) for

29. It _____ raining for two hours.

- a) has been b) could be
- c) might have d) is to be

30. _____ my father's permission, I went out.

- a) taken b) was taking
- c) having taken d) not taking

SECTION-III

Directions : Read the following passage and answer the questions given below following the instructions :

Polythene shopping bags are a threat to urban environment. Once you have discarded them after use you do not lose your link with them. They disrupt the sewer system, choke the

land mass and clog the pores of the wet lands. Millions of people, after preserving them for a time dispose them in wells, rivers and drains. Sometimes the worst offenders are the people living in posh colonies. Though educated, the residents of these affluent areas are unaware of the damage done by plastic bags. They callously throw them away and cause unhealthy environment. It is convenient for mothers to pack their children's food in plastic. All these wrappers are light in weight and are easily borne aloft in the wind causing visual shocks.

Choose the appropriate antonyms of the following :

31. Dispose

- a) throw b) get
- c) reject d) acquire

32. Affluent

- a) wealthy b) ordinary
- c) rich d) poor

33. Convenient

- a) difficult b) easy
- c) smooth d) hard

34. Threat

- a) danger b) risk
- c) promise d) protection

35. Disrupt

- a) stops b) breaks
- c) permits d) facilitates

Choose the appropriate synonyms of the following :

36. Discarded

- a) accepted b) dismissed
- c) rejected d) outwitted

37. Preserving

- a) saving b) destroying
- c) throwing d) keeping

38. Posh

- a) beautiful b) ugly
- c) repulsive d) elegant

39. Callously

- a) selfishly
- c) unkindly

- b) hard-heartedly
- d) carefully

40. Aloft

- a) low
- c) deep

- b) high
- d) top

SECTION-IV

Directions : In Questions 41-50 a part of the sentence is underlined. Below are given alternatives to the underlined part in a, b and c. Choose the correct alternative. In case no improvement is needed your answer is d.

41. Japanese armies effort to destroy the allied forces at Imphal and invade India, but were driven back into Burma.

- a) attempted to destroy
- b) experimented to destroy
- c) strengthened to destruct
- d) No improvement

42. He stopped to work an hour ago.

- a) worked
- b) to have worked
- c) working
- d) No improvement

43. My teacher is the kinder of all.

- a) kind
- b) kindly
- c) kindest
- d) No improvement

44. The accident occurred in the centre of the road.

- a) middle
- b) path
- c) way
- d) No improvement

45. Hardly had I reached the station when the train started.

- a) then
- b) than
- c) since
- d) No improvement

46. He is wilful to help you.

- a) willingly
- b) willing
- c) wilfully
- d) No improvement

47. His father died when he was very young.

- a) broke down
- b) passed away
- c) took off
- d) No improvement

48. She could not help laughing at his foolish-

ness.

- a) to laugh
- c) by laughing

- b) laughed
- d) No improvement

49. They could walk to school because it was close.

- a) start walking
- b) walking
- c) were walked
- d) No improvement

50. He is one of the bright student of his class.

- a) brightest students
- b) brighter student
- c) brightly students
- d) No improvement

PART - B - GENERAL KNOWLEDGE & APTITUDE

Marks : 50

Each question carries 2 marks :

Directions : (Q.No. 51 and 52) What should come in place of question mark (?) in the following number series ?

51. 289, 303, 324, 352, 387, 429, ?

- a) 478
- b) 508
- c) 487
- d) 558

52. 16, 24, 54, 81, 121.5, ?

- a) 200
- b) 195.75
- c) 182.25
- d) 150.5

53. Sum of present ages of A, B and C is 92 years. If 4 years ago, the ratio of their ages were 1 : 2 : 3 respectively, find the present age of A.

- a) 18.5 years
- b) 17.3 years
- c) 14.8 years
- d) 20.3 years

Directions : (Q.No. 54 and 55) What should come in place of question mark (?) in the following questions ?

54. 40% of 265 + 35% of 180 = 50% of ?

- a) 338
- b) 84.5
- c) 253.5
- d) 169

55. $4\frac{1}{5} \times 3\frac{1}{3} + ? = 20\%$ of 120

- a) $10\frac{1}{5}$
- b) 10
- c) 5
- d) 15

56. A certain sum is to be divided among A, B and C in the ratio 8 : 5 : 8 respectively. If the share of A and B together is Rs.500 more than that of C's share, then find the share of A

- a) Rs.800
- b) Rs.500
- c) Rs.600
- d) Rs.700

57. 21 binders can bind 1400 books in 15 days. How many binders will be required to bind 800 books in 20 days ?

- a) 7
- b) 9
- c) 12
- d) 14

58. A 250m long train crosses a signal pole in 15 seconds. What is the speed of the train in km/hr?

- a) 48
- b) 60
- c) 72
- d) 64

59. In an election between two candidates, one got 72% of the total valid votes. 25% of the total votes are invalid. If the total votes are 8200, what is the number of valid votes the other person got?

- a) 1835
- b) 1722
- c) 2050
- d) 4428

60. To which Republican tribe did Buddha belong ?

- a) Shakyas
- b) Lichchhavis
- c) Neither of these
- d) Both of these

61. With which one of the following movements is the slogan 'Do or Die' associated ?

- a) Swadeshi Movement
- b) Non-cooperation Movement
- c) Civil Disobedience Movement
- d) Quit India Movement

62. Which one of the following began with the Dandi March ?

- a) Home Rule Movement
- b) Non-cooperation Movement
- c) Civil Disobedience Movement
- d) Quit India Movement

63. How did the Communal Parties harm the interest of Nationalist Movement ?

- a) They never cooperated with the Congress
- b) They always blamed the Congress leaders
- c) Disunited the Indians by giving two nations theory
- d) None of these

64. Which among the following has the World's largest reserves of Uranium ?

- a) Canada
- b) Australia
- c) USA
- d) China

65. Cape Canaveral, the site from which space shuttles are launched is located on the coast of

- a) Virginia
- b) North Carolina
- c) Florida
- d) South Carolina

66. In India, the first Municipal Corporation was

set-up in which one among the following ?

- a) Kolkata
- b) Mumbai
- c) Chennai
- d) Delhi

67. Which of the following measures would result in an increase in the money supply in the economy ?

- i) Purchase of government securities from the public by the Central Bank
- ii) Deposit of currency in commercial banks by the public
- iii) Borrowing by the government from the Central Bank
- iv) Sale of government securities to the public by the Central Bank

Select the correct answer using the codes given below

- a) only (i)
- b) (ii) and (iv)
- c) (i) and (iii)
- d) (ii), (iii) and (iv)

68. Which one of the following National Parks has a climate that varies from tropical to sub-tropical, temperate and arctic ?

- a) Namdapha National Park
- b) Neora Valley National Park
- c) Nandadevi National Park
- d) Khangchendzonga National Park

69. The speed of a fluid or body is said to be supersonic if its Mach number is

- a) equal to zero
- b) equal to unity
- c) greater than unity
- d) less than unity

70. Scurvy is a disease resulting from deficiency of

- a) Vitamin-A
- b) Vitamin-B
- c) Vitamin-C
- d) Vitamin-D

71. Which one of the following organs of the human body secretes insulin ?

- a) Liver
- b) Pancreas
- c) Kidney
- d) Spleen

72. Who among the following created the first cloned sheep ?

- a) Adam Osborne
- b) Ian Wilmut
- c) Howard Aiken
- d) Herman Hollerith

73. When can the term of Lok Sabha be extended beyond five years ?

- a) Whenever the President likes
- b) Whenever the Election Commissioner

wishes

- c) Whenever the proclamation of National Emergency is in operation
- d) Where there is a war

74. If the interest rate is increased in an economy, it will

- a) increase the consumption expenditure in the economy
- b) increase the tax collection of the government
- c) decrease the investment expenditure in the economy
- d) decrease the total savings in the economy

75. If today is Thursday, after 132 days it will be

- a) Monday
- b) Sunday
- c) Wednesday
- d) Thursday

PART - C - MATHEMATICS

(OPTIONAL)

Marks :200

Each question carries 2 marks :

76. The quadratic polynomial $n^2 + n + 41$ is not a prime when n is equal to

- a) 36 b) 38
c) 39 d) 40

77. A particle is describing a central orbit under an attraction $\frac{\mu}{r^5}$ per unit mass. The speed v with which the particle can describe the circle $r = a$ is given by

- a) $\frac{\sqrt{\mu}}{a}$ b) $\frac{\mu}{a^2}$
c) $\frac{\sqrt{\mu}}{a^2}$ d) $\frac{\mu}{a^2}$

78. The moment of inertia of a uniform equilateral triangular lamina of side $2a$ and mass M , about a side, is

- a) $\frac{1}{2} Ma^2$ b) $\frac{1}{6} M a^2$
c) $\frac{1}{8} M a^2$ d) $M a^2$

79. A circular disc of radius a and mass M is rotating with uniform angular velocity ω about a fixed axis through the centre perpendicular to its plane. The kinetic energy of the disc is

- a) $\frac{1}{2} Ma^2 \omega^2$ b) $\frac{1}{4} Ma^2 \omega^2$
c) $Ma^2 \omega^2$ d) $\frac{1}{3} Ma^2 \omega^2$

80. Particles are projected from the same point, with the same velocity $2\sqrt{10g}$ m/s. Then the points where the particles strike the horizontal plane through the point of projection lie within a circle. The smallest such circle has radius

- a) 10 m b) 20 m
c) 30 m d) 40 m

81. Which of the following functions oscillates finitely as $x \rightarrow 0$?

- a) $\frac{\sin x}{x}$ b) $x \sin \frac{1}{x}$
c) $\sin \frac{1}{x}$ d) $\frac{1}{x} \sin \frac{1}{x}$

82. The singular integral of the partial differential equation $z = x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} - 2 \sqrt{\frac{\partial z}{\partial x} \cdot \frac{\partial z}{\partial y}}$ is

- a) $xy = 1$ b) $x + y = 1$
c) $y = x$ d) $y - x = 1$

83. Let R be an equivalence relation defined in the non-empty set A and let $x, y \in A$. If $[x]$ and $[y]$ are two distinct equivalent classes, then

- a) $[x] \cup [y] = \phi$ b) $[x] \cap [y] \neq \phi$
c) $[x] \cap [y] = \phi$ d) none of the above

84. If A be a skew-symmetric matrix of order 5 then $2A$ is

- a) a singular matrix b) non-singular matrix
c) symmetric matrix d) an invertible matrix

85. The characteristic roots of the matrix

$$\begin{bmatrix} -2 & -1 \\ 5 & 4 \end{bmatrix} \text{ are}$$

- a) 3, -1 b) 2, 1
c) -3, 2 d) 0, 1

86. The roots of a quadratic equation with rational coefficients, are always

- a) rational b) irrational
c) real d) none of the above

87. If α, β, γ are the roots of the equation

$$x^3 - px^2 + qx - r = 0, \text{ then the value of } \frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} \text{ is}$$

- a) $\frac{q}{r}$ b) $-\frac{q}{r}$
c) $\frac{r}{q}$ d) $-\frac{r}{q}$

88. If the sum of two real numbers is an irrational number, then both the numbers cannot be
 a) irrational b) rational
 c) positive d) none of the above

89. Let a be an element of a group G and n , the least positive integer satisfying $a^n = e$, e being the identity element. Then $a^m = e$ if
 a) n is a divisor of m b) m is a divisor of n
 c) $m < n$ d) $m = 2n + 1$

90. How many elements of the group $G = \{a, a^2, a^3, a^4, a^5, a^6 = e\}$ can be used as generator of the group?
 a) 6 b) 4
 c) 3 d) 2

91. The digit in the unit's place of the number 3^{101} , is
 a) 3 b) 1
 c) 9 d) 7

92. If $f(x) = x^2$ be defined in $S = [-2, 1]$, then $\sup f(S) + \inf f(S) =$
 a) 3 b) 4
 c) 5 d) does not exist

93. The function $f: R \rightarrow R$ defined by $f(x) = x$ is
 a) uniformly continuous and bounded
 b) bounded but not uniformly continuous
 c) uniformly continuous but not bounded
 d) both bounded and uniformly continuous

94. If $y = \cos x$, then the value of $\frac{d^{10}y}{dx^{10}}$ at $x = 0$, is equal to
 a) 1 b) -1
 c) 0 d) none of the above

95. The curve $y = x \frac{x^2 + a^2}{x^2 - a^2}$ has asymptote
 asymptotes
 a) parallel to the axis of x
 b) parallel to the axis of y
 c) parallel to $y = 2x$
 d) none of the above

96. If $x = \int_0^y \frac{dt}{\sqrt{1+4t^2}}$, then $\frac{d^2y}{dx^2}$ is proportional
 to

- a) y b) x
 c) y^2 d) $\frac{1}{y^2}$

97. The set $S = \left\{ \frac{(-1)^n}{n} : n \in N \right\}$ is
 a) bounded below b) bounded above
 c) bounded d) all of the above

98. The set $A = \left\{ \frac{1}{n} : n \in N \right\}$ has
 a) exactly one limit point
 b) exactly two limit points
 c) infinitely many limit points
 d) no limit point

99. Every _____ set of real numbers has a limit point. (Fill in the blank with the correct option)
 a) infinite bounded b) infinite
 c) bounded d) finite

100. If the infinite series $\sum u_n; u_n \in R$, is convergent, then the sequence $\{u_n\}$
 a) is monotonic b) converges to 0
 c) diverges to ∞ d) none of the above

101. The series : $\frac{1}{1.2} - \frac{1}{2.3} + \frac{1}{3.4} - \dots$,
 a) is convergent
 b) is absolutely convergent
 c) is an alternating series
 d) all of the above

102. If $S_n = \frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \dots + \frac{1}{2n}$,
 then $\lim_{n \rightarrow \infty} S_n$ equals

- a) 2 b) $\frac{\pi}{4}$
 c) $\log 2$ d) does not exist

103. The improper integral $\int_0^\infty \frac{dx}{a^2 + x^2}$
 a) converges to $\frac{\pi}{2}$ b) is divergent
 c) converges to $\frac{\pi}{2a}$ d) none of the above

104. If $u = \sin^{-1} \left(\frac{x+y}{\sqrt{x} + \sqrt{y}} \right)$ then
 a) u is a homogeneous function in x and y of

degree $\frac{1}{2}$

b) $\sin u$ is a homogeneous function in x and y of

degree $\frac{1}{2}$

c) $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2}u$

d) $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \sin u$

105. If $x = r \cos \theta$, $y = r \sin \theta$, then $\frac{\partial(x,y)}{\partial(r,\theta)}$

is equal to

a) r^2 b) $\frac{1}{r}$

c) $r \sin \theta \cos \theta$ d) r

106. An integrating factor of the linear differential equation $(1 + y^2)dx = (\tan^{-1} y - x)dy$ is

a) e^x b) $e^{\tan^{-1} y}$

c) $e^{\tan^{-1} x}$ d) x

107. The particular integral (P.I.) of the differential equation $(D - 1)^2(D^2 + 1)^2y = e^x$ is

a) $\frac{1}{2}x^2e^x$ b) $\frac{1}{4}x^2e^x$

c) $\frac{1}{4}xe^x$ d) $\frac{1}{8}x^2e^x$

108. If $|\vec{a}|$ is a constant, then

a) $\frac{d\vec{a}}{dt} = \vec{0}$ b) $\vec{a} \cdot \frac{d\vec{a}}{dt} = 0$

c) $\vec{a} \times \frac{d\vec{a}}{dt} = \vec{0}$ d) none of the above

109. The equation $x^2 - 3xy + y^2 + 10x - 10y = 0$ represents

- a) an ellipse b) a hyperbola
c) a parabola d) a pair of straight lines

110. In general the equations, $x^2 + y^2 + z^2 + 2ux + 2vz + d = 0$ and $lx + my + nz = p$, taken together represent

- a) a cone b) a sphere
c) a cylinder d) a circle

111. The value of $\lim_{(x,y) \rightarrow (0,0)} \frac{xy^3}{x^2 + y^6}$, along the path $x = y^3$

- a) is equal to 1 b) is equal to $\frac{1}{3}$

- c) is equal to $\frac{1}{2}$ d) does not exist

112. The value of the line integral $\int_C (x^2 dx - xy dy)$, where C is the arc of the parabola $y^2 = x$ from $(0,0)$ to $(1,1)$, is

a) $\frac{1}{2}$ b) $\frac{1}{12}$

c) $\frac{2}{3}$ d) $\frac{1}{6}$

113. A particle is describing a circle with uniform angular velocity, then

- a) the velocity of the particle is uniform
b) the velocity of the particle is the same at every point of its path
c) the speed of the particle is uniform
d) none of the above

114. The largest positive integer n such that 3^n divides $100!$, is

- a) 64 b) 52
c) 40 d) 48

115. Which of the following infinite series does not converge?

a) $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots$

b) $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots$

c) $1 + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{4}} + \dots$

d) $1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} - \frac{1}{\sqrt{4}} + \dots$

116. The centre of gravity G , of two masses, m at A and $2m$ at B is a point on \overline{AB} such that

- a) $AG : GB = 1 : 2$
b) $AG : GB = 2 : 1$
c) $AG : GB = 1 : 3$
d) none of the above

117. If $f(x)$ is defined in $[0, 1]$, then the domain

of the function $f(4x^2)$ is

- a) $[0, 4]$ b) $[-4, 4]$
 c) $\left[-\frac{1}{2}, \frac{1}{2}\right]$ d) $[-2, 2]$

118. If the displacement x of a particle moving in a straight line is given by the equation

$x = a \cos \omega t + b \sin \omega t$, then the particle executes S.H.M. of period

- a) $\frac{2\pi}{\omega^2}$ b) $\frac{2\pi}{\sqrt{\omega}}$
 c) $\frac{\pi}{\omega}$ d) $\frac{2\pi}{\omega}$

119. A binary operation $*$ is defined on the set $A = \{a, b, c\}$ by the following composition table.

$*$	a	b	c
a	a	b	c
b	b	c	a
c	c	a	b

Then $b*(b*b)$ is equal to

- a) b b) a
 c) c d) cannot be determined

120. The diagonal elements of a Hermitian matrix are necessarily

- a) purely real
 b) purely imaginary
 c) non-real complex numbers
 d) none of the above

121. If the vector $\vec{f} = 3x\hat{i} + (x+y)\hat{j} - az\hat{k}$ is solenoidal, then a is equal to

- a) -2 b) 3
 c) 4 d) -1

122. The remainder, when $1! + 2! + 3! + 4! + 5! + \dots$ is divided by 12, is

- a) 3 b) 4
 c) 6 d) 9

123. For the linear transformation $T: R^4 \rightarrow R^4$ defined by

$T(x, y, z, u) = (x, y, 0, 0), \forall (x, y, z, u) \in R^4$ we have

- a) rank of $T >$ nullity of T
 b) nullity of $T <$ rank of T

c) rank of $T =$ nullity of $T = 3$

d) rank of $T =$ nullity of $T = 2$

124. If $V = R^4(R)$, $S = \{(2, 0, 0, 1), (-1, 0, 1, 0)\}$, then $L(S)$ is

- a) $\{(2\alpha, 0, \beta, \alpha) : \alpha, \beta \in R\}$
 b) $\{(2\alpha - \beta, 0, 0, \alpha) : \alpha, \beta \in R\}$
 c) $\{(2\alpha - \beta, 0, \beta, \alpha) : \alpha, \beta \in R\}$
 d) none of the above

125. $\lim_{x \rightarrow 0} \frac{\sin \frac{1}{x}}{\frac{1}{\sin x}}$ equals

- a) 1 b) 0
 c) ∞ d) does not exist

126. The sets $G = \{-1, 1\}$ and $H = \{x : x \in Z, x^2 - 1 = 0\}$ are

- a) disjoint sets b) equal sets
 c) unequal sets d) none of these

127. If A and B are any sets. Then $(A - B) \cap B$ is equal to

- a) B b) A
 c) \emptyset d) $A - B$

128. The function $f: R \rightarrow R$ defined by $f(x) = x^2$ is

- a) only one-one
 b) only onto
 c) both one-one and onto
 d) neither one-one nor onto

129. The range of the real function f defined by

$$f(x) = \frac{x^2}{1+x^2} \text{ is}$$

- a) $x < 0$ b) $x > 1$
 c) $0 < x < 1$ d) $0 \leq x < 1$

130. Let \mathfrak{R} be the set of real numbers. The relation $R = \{(a, b) : a^2 + b^2 = 1\}$ on \mathfrak{R} is

- a) Reflexive b) Symmetric
 c) Transitive d) an equivalence relation

131. Let $*$ be a binary operation on Z defined by $a * b = a + b + 1$ for all $a, b \in Z$. The identity element in Z

- a) -1 b) 0
 c) 1 d) does not exist

132. Let A and B be two matrices. Then the matrix equation $A^2 - B^2 = (A-B)(A+B)$ is true if

- a) $AB=BA$ b) $AB=B^2$
c) $A^2=0$ d) $A \neq B$

133. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ is

- a) 0 b) 1
c) 2 d) 3

134. If A is a square matrix of order 6, then

- a) $\det(7A) = 7\det(A)$
b) $\det(7A) = 6^7\det(A)$
c) $\det(7A) = 42\det(A)$
d) $\det(7A) = 7^6\det(A)$

135. A square matrix A is said to be singular if

- a) $|A| > 0$ b) $|A| < 0$
c) $|A| = 0$ d) $|A| = 1$

136. $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$ is equal to

- a) $\frac{1}{2}$ b) $\frac{\pi}{2}$
c) π d) 1

137. $\lim_{x \rightarrow 1} \frac{x^2 - 3x + 2}{x^2 - 4x + 3}$ is

- a) 1 b) $\frac{1}{2}$
c) $\frac{1}{4}$ d) 0

138. The value of k for which the function

$$f(x) = \begin{cases} kx + 5, & \text{when } x \leq 2 \\ x - 1, & \text{when } x > 2 \end{cases}$$

is continuous at $x = 2$ is

- a) -2 b) -1
c) 1 d) 2

139. The greatest integer function $f(x) = [x]$ for all $x \in \mathbb{R}$ (where \mathbb{R} is the set of real numbers) is

- a) continuous for all $x \in \mathbb{R}$
b) discontinuous for all $x \in \mathbb{R}$
c) discontinuous for all $x \in \mathbb{Z}$
d) continuous for all $x \in \mathbb{Z}$

140. The derivative of $\sec x$ with respect to $\tan x$ is

- a) $\tan x$ b) $\cos x$
c) $\sec x \tan x$ d) $\sin x$

141. If $y = \sin^{-1} \frac{x}{a}$, then $\frac{dy}{dx}$ is equal to

- a) $\frac{1}{\sqrt{a^2 + x^2}}$ b) $\frac{1}{\sqrt{a^2 - x^2}}$
c) $\frac{a}{\sqrt{a^2 - x^2}}$ d) $\frac{a}{\sqrt{a^2 + x^2}}$

142. When $xy = c^2$, then $\frac{dy}{dx} =$

- a) $\frac{1}{x^2}$ b) $-\frac{1}{x^2}$
c) $\frac{c^2}{x^2}$ d) $-\frac{c^2}{x^2}$

143. If $e^y(x+1) = 1$, then $\frac{d^2y}{dx^2} =$

- a) $\left(\frac{dy}{dx}\right)^2$ b) $\frac{dy}{dx}$
c) $-\frac{dy}{dx}$ d) 0

144. $\int e^{2x}(-\sin x + 2 \cos x) dx =$

- a) $e^{2x} \sin x$ b) $\sin x$
c) $e^{2x} \cos x$ d) $\cos x$

145. $\int \frac{\sin \sqrt{x}}{\sqrt{x}} dx =$

- a) $2 \sin \sqrt{x}$ b) $-2 \sin \sqrt{x}$
c) $-2 \cos \sqrt{x}$ d) $2 \cos \sqrt{x}$

146. $\int \sin x^0 dx =$

- a) $-\frac{180}{\pi} \cos x$ b) $-\frac{180}{\pi} \cos x^0$
c) $-\cos x$ d) $-\cos x^0$

147. The area of the region bounded by the line $2y + x = 8$, the x-axis and the lines $x = 2$ and $x = 4$ is

- a) 5 sq units b) 4 sq units
c) 3 sq units d) 2.5 sq units

148. The degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^3 + 2\left(\frac{dy}{dx}\right)^4 + 9 = \sin x \text{ is}$$

- a) 1 b) 2
c) 3 d) 4

149. The differential equation of the family of all straight lines is

- a) $\frac{dy}{dx} = 0$ b) $\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$
c) $\frac{d^2y}{dx^2} = 0$ d) $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

150. The solution of the differential equation

$$(x^2 + 1) \frac{dy}{dx} = xy \text{ is}$$

- a) $y = C\sqrt{x^2 - 1}$ b) $y = C\sqrt{x^2 + 1}$
c) $y = C\sqrt{1 - x^2}$ d) None of these

151. An integrating factor of the differential

$$\text{equation } \frac{dy}{dx} + y \cot x = 2 \cos x \text{ is}$$

- a) $\log(\sin x)$ b) $\log(\cos x)$
c) $\cos x$ d) $\sin x$

152. In a rectangular hyperbola $x^2 - y^2 = a^2$, the eccentricity is given by

- a) 2 b) 1
c) $\sqrt{2}$ d) -1

153. The length of the latus rectum of the ellipse

$$\frac{x^2}{7} + \frac{2y^2}{7} = 1 \text{ is}$$

- a) 7 b) $\frac{1}{2}$
c) $\sqrt{2}$ d) $\sqrt{7}$

154. The sequence $\{S_n\}$ where $S_n = n(-1)^n$, $n \in \mathbb{N}$

- a) is convergent b) is divergent
c) oscillates finitely d) oscillates infinitely

155. If $a_n = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)}$, then the

sequence $\{a_n\}$ is

- a) monotonically increasing
b) monotonically decreasing
c) unbounded

d) none of these

156. The series $1^3 + 2^3 + 3^3 + \dots + n^3 + \dots$ is

- a) convergent b) divergent
c) oscillates finitely d) oscillates infinitely

157. The positive term geometric series $1 + r + r^2 + \dots$ converges for

- a) $r < 1$ b) $r = 1$
c) $r > 1$ d) none of these

158. A rigid body in static equilibrium experiences

- a) no balanced forces
b) no unbalanced force
c) only small forces
d) only large forces

159. The couple is composed of a pair of forces that are

- a) unequal, opposite and parallel
b) unequal, opposite and non-parallel
c) equal, opposite and parallel
d) equal and parallel

160. Which of the following attributes does not characterize a force ?

- a) Magnitude b) direction
c) line of action d) centre of rotation

161. A train travelling at 30 km/hr is brought to rest uniformly at a station in $1\frac{1}{2}$ minutes. At

what distance from the station were the brakes applied ?

- a) 375 m b) 270 m
c) 138 m d) 90 m

162. A body is thrown vertically upwards and rises to a height of 10 m. The time taken by the body to reach the highest point is

- a) $\frac{10}{7}$ sec b) 10 sec
c) 14 sec d) 16 sec

163. The equation of a parabola with focus S (a, 0) as origin is

- a) $y^2 = 4a(x + a)$ b) $y^2 = 4a(x - a)$
c) $y^2 = 2a(x + a)$ d) $y^2 = 4a(a - x)$

164. The Cartesian equation of a line passing through a point with position vector $(2\hat{i} - \hat{j} + \hat{k})$ and parallel to the line joining the points $(-\hat{i} + 4\hat{j} + \hat{k})$ and $(\hat{i} + 2\hat{j} + 2\hat{k})$ is

- a) $\frac{x-2}{-2} = \frac{y+1}{2} = \frac{z-1}{-1}$
 b) $\frac{x-2}{2} = \frac{y+1}{2} = \frac{1-z}{1}$
 c) $\frac{x+2}{2} = \frac{y-1}{-2} = \frac{z+1}{1}$
 d) $\frac{x-2}{2} = \frac{y+1}{-2} = \frac{z-1}{1}$

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

- a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$
 c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

166. The equation of the cone whose vertex is the origin and the guiding curve is given by $x + 2y + 3z = 4$ and $5x^2 + 7y^2 - 3z + 2 = 0$ is

- a) $41x^2 + 60y^2 - 9z^2 = 0$
 b) $41x^2 + 60y^2 - 9z^2 + 4xy = 0$
 c) $41x^2 + 60y^2 - 9z^2 + 4yz = 0$
 d) $41x^2 + 60y^2 - 9z^2 + 4zx = 0$

167. The direction cosines of the vector $\vec{a} = 5\hat{i} - 3\hat{j} + 4\hat{k}$ are

- a) 5, -3, 4 b) $\frac{1}{\sqrt{2}}, \frac{3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$
 c) $\frac{5}{\sqrt{2}}, \frac{-3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$ d) $\frac{1}{\sqrt{2}}, \frac{-3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$

168. $(\hat{i} \times \hat{j}) \times \hat{k} + (\hat{j} \times \hat{k}) \times \hat{i} + (\hat{k} \times \hat{i}) \times \hat{j}$ is equal to

- a) a zero vector b) 0
 c) \hat{i} d) $\hat{i} + \hat{j}$

169. If $G = \left\{ \begin{bmatrix} a & 0 \\ 0 & 0 \end{bmatrix} : a \text{ is any non zero real} \right\}$

number $\left. \vphantom{\begin{matrix} \\ \end{matrix}} \right\}$, then

- a) G is not a group under matrix multiplication
 b) G is a non-commutative group under matrix multiplication
 c) G is a commutative group under matrix multiplication
 d) none of these

170. Which of the following is a subgroup of the multiplicative group $\{1, -1, i, -i\}$

- a) $\{1, i\}$ b) $\{1, -1\}$
 c) $\{1, -i\}$ d) $\{i, -i\}$

171. An infinite cyclic group has exactly

- a) one generator b) two generators
 c) three generators d) infinite generators

172. The roots of the equation $x^3 - 3x^2 + 4 = 0$ when two of its roots are equal are

- a) 2, 2, 1 b) -1, -1, 3
 c) 2, 2, -1 d) -1, -1, 0

173. Find the quotient when $3x^7 - x^6 + 31x^4 + 21x + 5 = 0$ is divided by $(x + 2)$

- a) $x^6 + 3x^2 - 5$
 b) $3x^6 - 7x^5 + 14x^4 + 3x^3 - 6x^2 + 12x - 3$
 c) $x^6 + 12x^4 + 3x^3 + 5x^2 - 7$
 d) 11

174. If α, β, γ are the roots of the equation

$x^3 + px + q = 0$, then the value of $\sum \frac{1}{\alpha + \beta}$ is

- a) $-\frac{q}{p}$ b) $\frac{q}{p}$
 c) $\frac{p}{q}$ d) $-\frac{p}{q}$

175. If $f(x, y, z) = xy + yz + zx$, then the gradient vector of f at the point $(-1, 1, 1)$ is

- a) 0 b) \hat{j}
 c) $2\hat{j}$ d) $2\hat{i}$

PART - C - ECONOMICS

(OPTIONAL)

Marks :200

Each question carries 2 marks :

76. The marginal utility analysis is based on

- a) Ordinal measurement of utility
- b) Hypothesis of dependent utilities
- c) Total utility of money
- d) Introspective method

77. Ricardo's theory of rent considers the supply of land from the view point of

- a) an individual
- b) the family
- c) the society
- d) all of the above

78. Quasi rent is defined as

- a) Total variable cost minus total revenue
- b) Total revenue minus total variable cost
- c) Total receipts minus total cost
- d) Total cost minus total receipts

79. The shut-down point of the firm in the short-run is

- a) Price = minimum MC
- b) Price = minimum AC
- c) Price = minimum AVC
- d) None of the above

80. Real wages of the workers are affected by

- a) Level of prices
- b) Supplementary earnings
- c) Conditions of work
- d) all of the above

81. In the Loanable Funds theory, the rate of interest is determined by

- a) the supply of loanable funds
- b) Investment
- c) the demand and supply of loanable funds
- d) Bank money

82. According to whom "It is not dynamic change, nor any change as such which causes profits, but divergence of actual conditions from those which have been expected and on the basis of which business arrangements have been made."

a) H.B.Hawley

c) J.M.Keynes

b) F.H. Knight

d) J.A.Schumpeter

83. To achieve Pareto optimality and optimum allocation of factors, which of the following is necessary

a) $MRS_{X_1Y}^A = MRS_{X_1Y}^B$

b) $MRTS_{L_1K}^X = MRTS_{L_1K}^Y$

c) $MRPT_{X_1Y} = MRS_{X_1Y}^A = MRS_{X_1Y}^B$

d) None of these

84. Monopsony is a market condition in which

- a) there is no buyer of a commodity or service.
- b) there is a single buyer of a commodity or service
- c) there is no seller of a commodity or service needed by the consumers
- d) there is a single seller of a commodity or service

85. "Economics is the study of how men and society choose, with or without money, to employ scarce productive resources which could have alternative uses, to produce various commodities overtime, and distribute them for consumption now and in future among various people and groups of society." Whose words are these?

a) Robbins

b) Adam Smith

c) Samuelson

d) Benham

86. Micro-economic analysis is concerned with the study of

- a) price of individual goods
- b) general price level
- c) level of national income and employment
- d) none of the above

87. In a demand schedule, the quantity demanded

- a) varies inversely with price
- b) varies inversely with income
- c) varies proportionately with price
- d) varies due to change in income

88. Diminishing marginal rate of substitution of good X for good Y implies that the indifference

curve is

- a) linear
- b) concave to the origin
- c) convex to the origin
- d) none of the above

89. On a demand curve where elasticity equals one / unity, the value of marginal revenue equals

- a) one
- b) more than one
- c) less than one
- d) zero

90. The change in quantity demanded of a product due to a change in relative price alone and real income remaining constant is called the

- a) price effect
- b) substitution effect
- c) income effect
- d) none of the above

91. Marginal utility is negative when total utility is

- a) increasing
- b) constant
- c) decreasing
- d) none of the above

92. An increase in demand is shown by a movement

- a) lower down the same curve
- b) to a curve, right of the original
- c) to a curve, left of the original
- d) none of the above

93. With an increase in output as both the average cost and marginal cost fall.

- a) $MC > AC$
- b) $MC < AC$
- c) $MC = AC$
- d) MC curve cuts MR curve from below

94. Under perfect competition, a straight-line parallel to the X-axis represents

- a) average revenue
- b) marginal revenue
- c) price
- d) all of the above

95. A common factor responsible for the stage of increasing returns and the stage of diminishing returns is

- a) indivisibility of the fixed factor
- b) excess capital
- c) excess labour
- d) excess capital and labour

96. In the case of increasing returns to scale, the distance between successive multiple output level isoquants as we move along an isocline would

- a) increase
- b) decrease
- c) remain constant
- d) none of the above

97. If AR and MR curves are falling and straight lines, then the MR curve would cut any perpendicular from the Y-axis to the AR curve

- a) more than halfway
- b) less than halfway
- c) exactly halfway
- d) none of the above

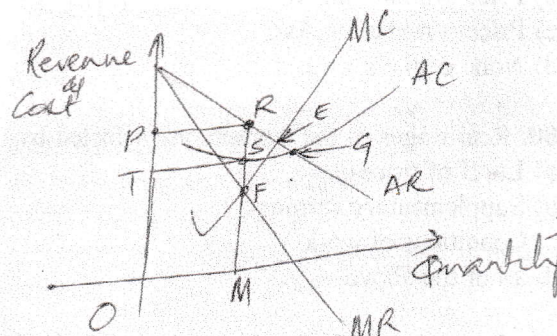
98. There is no distinction between firm and industry under

- a) perfect competition
- b) duopoly
- c) oligopoly
- d) monopoly

99. A market with few sellers producing either homogeneous products or close substitutes is known as

- a) monopoly market
- b) duopoly market
- c) oligopoly market
- d) monopolistic competition

Directions : Use the given diagram to answer Q.No. 100 & 101.



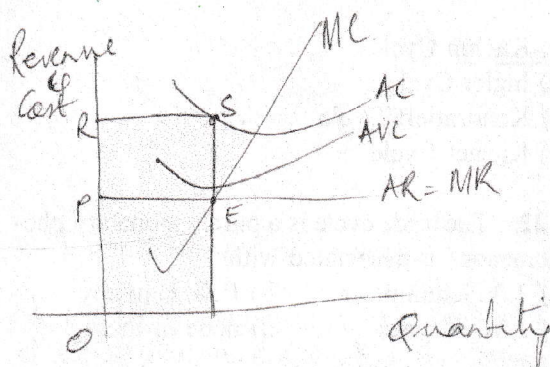
100. Which is the equilibrium point ?

- a) Point E
- b) Point G
- c) Point S
- d) Point F

101. What does area PRST represent ?

- a) Supernormal profit
- b) Normal profit
- c) Loss
- d) None of these

Directions : Use the following diagram to answer Q.No. 102 & 103.



102. What does area PRSE represent ?

- a) Supernormal profit
- b) Normal profit
- c) Loss
- d) None of these

103. What will the firm do ?

- a) continue production
- b) shut down
- c) not enough information to decide
- d) none of these

104. Multiplier is calculated by which formula?

- a) $\frac{1}{1 - \frac{\Delta C}{\Delta S}}$
- b) $\frac{1}{1 - \frac{\Delta C}{\Delta Y}}$
- c) $\frac{1}{1 - \frac{\Delta S}{\Delta Y}}$
- d) $\frac{1}{1 + \frac{\Delta C}{\Delta Y}}$

105. Which of the following statement is incorrect ?

- a) MEC is based on supply price of capital and MEI on induced changes in this price.
- b) MEC shows the returns on all successive units of capital without regard to existing capital stock.
- c) MEI shows the rate of return on only units of capital over and above the existing stock of capital
- d) MEC determines the net investment at different interest rates while MEI determines the optimum capital stock at each level of interest rate

106. "The desire to provide for contingencies requiring sudden expenditures and for unforeseen opportunities of advantageous purchases" relates to

- a) Transaction Motive
- b) Precautionary Motive
- c) Speculative Motive

d) None of these

107. If the rate of rise in prices is in the intermediate range of 3 to 7 percent per annum or less than 10 percent, it is a case of

- a) Creeping inflation
- b) Walking inflation
- c) Running inflation
- d) Hyper inflation

108. Who said the following "The distinction between cost-push and demand-pull inflation is unworkable, irrelevant or even meaningless."

- a) Keynes
- b) Lipsey
- c) F. Machlup
- d) H.G. Johnson

109. Choose the incorrect one from the following

- a) $APC = \frac{C}{Y}$
- b) $MPC = \frac{\Delta C}{\Delta Y}$
- c) $MPC + MPS = 1$
- d) $APC + MPC = 1$

110. According to J.B. Say

- a) supply is equal to demand
- b) supply is always less than demand
- c) supply is greater than demand
- d) supply always creates its own demand

111. Raising or lowering of the Central Bank's discount rate is known as

- a) Open market operations
- b) Cash reserve ration
- c) Bank Rate Policy
- d) None of the above

112. Which is not a function of a commercial bank ?

- a) Accepting Deposits
- b) Credit Creation
- c) Controlling of credit
- d) Discounting bills of exchange

113. National income at factor cost equals

- a) NNP - indirect taxes + subsidies
- b) NNP - indirect taxes - subsidies
- c) NNP - direct taxes + subsidies
- d) NNP - depreciation

114. In the equation $MV = PT$, with V and T remaining constant, when M increases, what happens to P ?

- a) Remains constant

- b) Varies inversely
- c) Increases in the same proportion
- d) Decreases in the same proportion

115. Which of the following is a selective credit control ?

- a) Open market operation
- b) Variable cash reserve ratio
- c) Regulation bank rate
- d) Regulation of margin requirements

116. Which of the following is not assumed under the Classical Theory of Employment ?

- a) closed laissez-faire economy
- b) wage-price rigidity
- c) full employment
- d) total output is divided between consumption and investment

117. In the Keynesian model, effective demand is determined by

- a) consumption + investment
- b) consumption + investment + Government expenditure
- c) consumption + investment + saving
- d) none of the above

118. Given $C = a + bY$, as income increases, which of the following would be untrue ?

- a) APC falls
- b) MPC rises
- c) APC is greater than MPC
- d) none of the above

119. Autonomous investment is not influenced by

- a) innovations
- b) population growth
- c) social and legal institutions
- d) level of income

120. A paradoxical situation where the economy experiences stagnation or unemployment along with a high rate of inflation is referred to as

- a) Markup inflation
- b) Structural inflation
- c) Stagflation
- d) none of these

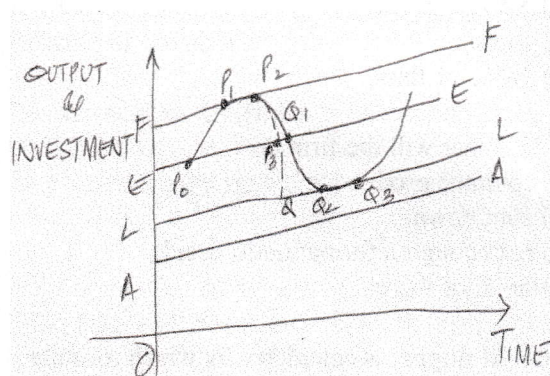
121. Business cycles that are longer waves of cycles of more than 50 years duration, made of six Ingler Cycles are called

- a) Kitchin Cycle
- b) Ingler Cycle
- c) Kondratieff Cycle
- d) Kuznet Cycle

122. "The trade cycle is a purely monetary phenomenon" is associated with

- a) J.A. Schumpeter
- b) R.G. Hawtrey
- c) J.M. Keynes
- d) none of these

Directions : Use the given diagram to answer Q.No. 123 to 125.



123. The path of autonomous investment is shown by line

- a) FF
- b) EE
- c) LL
- d) AA

124. The 'slump equilibrium line' or lower equilibrium line is

- a) FF
- b) EE
- c) LL
- d) AA

125. Between Q_1 & Q_2

- a) only accelerator is operative
- b) only multiplier is operative
- c) both accelerator and multiplier are operative
- d) none of these

126. Under Balance of Payments, the Balance of trade refers to the difference between

- a) visible exports and imports
- b) visible and invisible exports and invisible exports and imports
- c) all credit and debit items in the current account
- d) none of these

127. In the balance of payment account, export and import of services are recorded in

- a) Capital Account
- b) Merchandise Account

- c) Current Account
- d) Revenue Account

128. A tax that takes a larger percentage of people's income the larger is their income is known as

- a) regressive tax
- b) proportional tax
- c) progressive tax
- d) tax with social justice

129. "Public finance deals with expenditure and income of public authorities and their mutual relation as also with financial administration and controls" according to

- a) C.F. Bastable
- b) H. Dalton
- c) R.A. Musgrave
- d) Adam Smith

130. Which of the following is not a feature of a tax ?

- a) Tax is a compulsory payment and non-payment leads to punishment
- b) Tax involves some sacrifice to the tax payer
- c) Income collected is spent for the benefit of public welfare
- d) There is quid pro quo between the amount of tax paid and the benefit received

131. Repudiation of Debt means

- a) a fund created for redemption of public debt
- b) the government pays back the amount of public debt in terminable annuities
- c) refusal by the government to honour its debt obligations.
- d) none of the above

132. As per World Bank (2015) and World Development Report (2015), India's population as a percentage of world population was

- a) 15.8%
- b) 16.8%
- c) 17.8%
- d) 18.8%

133. The per capita income of an Indian in 2014 was

- a) \$1570
- b) \$1670
- c) \$1770
- d) \$1470

134. As per the Economic Survey 2017-18, the Fourth Advance Estimates for 2016-17, India achieved a record production of food grains estimated at

- a) 265 million tonnes
- b) 272.3 million tonnes

- c) 275.7 million tonnes
- d) 277 million tonnes

135. The growth rate of country's population during 2001-11 stood at 17.7%. In rural and urban areas of the country it was

- a) 31.8% and 12.3% respectively
- b) 12.3% and 31.8% respectively
- c) 16.4% and 28.6% respectively
- d) 14.6% and 12.3% respectively

136. Female literacy in the country, as per the final census 2011 stands at

- a) 70.3%
- b) 68.2%
- c) 64.6%
- d) 62.3%

137. As per 2011 census data, the literacy rate in India stood at

- a) 66.4%
- b) 68.9%
- c) 73%
- d) 74.2%

138. According to WTO, India's share of World Merchandise Trade in 2015 was

- a) 1.5%
- b) 1.6%
- c) 1.7%
- d) 1.8%

139. Major Commercial banks of India were nationalised in the year

- a) 1950
- b) 1956
- c) 1969
- d) 1980

140. Which year is called the "Year of the great divide" in the history of population growth in India ?

- a) 1971
- b) 2000
- c) 1921
- d) 2011

141. Marginal farmers in India are those who hold land upto

- a) 1 hectare
- b) 2 hectares
- c) 3 hectares
- d) 4 hectares

142. Which is the highest export-oriented handicrafts (in value terms) in Indian exports ?

- a) Brass goods
- b) Ivory goods
- c) Leather goods
- d) Gems and ornaments

143. New series of national income with base year 2011-12 has introduced "GVA at basic prices" in place of

- a) GDP_{MP}
- b) GDP_{FC}

- c) NDP_{MP} d) GNP_{MP}

144. FDI ceiling in defence sector has been raised to

- a) 49% b) 51%
c) 74% d) 100%

145. In which plan, phase of heavy industrialisation was initiated

- a) First b) Second
c) Third d) Fourth

146. In the new IIP (base 2004-05), the weight of manufacturing is

- a) 75.53% b) 76.36%
c) 78.22% d) 79.39%

147. "Stand-up India" scheme is associated with

- a) small entrepreneurs
b) SC/ST entrepreneurs
c) only women entrepreneurs
d) only entrepreneurs in rural areas

148. National Food Security Act 2013 ensures the supply of Wheat and Rice at

- a) Rs.3 and Rs.4 respectively
b) Rs.2 and Rs.3 respectively
c) Rs.2 and Rs.4 respectively
d) Rs.1 and Rs.2 respectively

149. Which of the following sectors got the maximum FDI inflow during April-September period of 2016-17 ?

- a) Trading
b) Computer hardware and software
c) Automobiles
d) Telecom

150. SEBI is a

- a) Statutory body
b) Advisory Body
c) Constitutional body
d) Non-statutory body

151. MPI or Multidimensional Poverty Index is a new index included in

- a) World Human Report
b) Human Development Report
c) World Development Report
d) India's Human Development Report

152. The new base year of the newly constituted wholesale Price Index on the recommen-

dation of Abhijit Sen Committee is

- a) 2000-01 b) 2002-03
c) 2004-05 d) 2005-06

153. Which state has been announced as 'a state of total organic farming'?

- a) Karnataka b) Kerala
c) Punjab d) Sikkim

154. In the new IIP series with base year 2004-05, the number of item groups in the manufacturing has gone up from

- a) 473 to 520 b) 473 to 620
c) 507 to 620 d) 538 to 638

155. The state with the least poverty ratio in the country is

- a) Goa b) Kerala
c) Himachal Pradesh d) Punjab

156. The maximum foreign companies are registered in which city ?

- a) Mumbai b) Gurgaon
c) Bengaluru d) New Delhi

157. The National Food Security Mission targets to increase the production of foodgrains in the 12th Plan by

- a) 15 million tonnes
b) 20 million tonnes
c) 25 million tonnes
d) 27 million tonnes

158. National Income estimates in India is prepared by

- a) Planning Commission b) RBI
c) Local bodies d) C.S.O.

159. Which of the following are the brand ambassadors of India ?

- a) Tea and Coffee
b) Coffee and spices
c) Tea and Rubber
d) Tea and spices

160. India's rank in Global Competitive Index 2016 stood at

- a) 40th b) 41st
c) 42nd d) 43rd

161. Fiscal policy does not deal with

- a) Taxation
b) Public Expenditure

- c) Credit expansion and contraction
- d) Deficit Financing

- a) 114th
- b) 116th
- c) 118th
- d) 120th

162. The work participation Rate as per the Census 2011 is

- a) 39.8%
- b) 42.3%
- c) 43.6%
- d) 45.2%

163. The document signifying the road map of socio-economic development of North-East State is known as

- a) Vision 1010
- b) Vision 2012
- c) Vision 2020
- d) Vision 2025

164. The 12th Plan Document puts the manufacturing growth target at

- a) 7.6% p.a.
- b) 8.6% p.a.
- c) 10% p.a.
- d) 10.7% p.a.

165. National Rural Employment Guarantee Act, 2005 ensures for how many days of employment in rural areas ?

- a) 100 days
- b) 150 days
- c) 200 days
- d) 365 days

166. Licence compulsion has been removed for a number of industries under liberalisation and deregulation. The number having licence restrictions at present is

- a) 4
- b) 5
- c) 6
- d) 9

167. Which sector constitutes the maximum share in National Income in India ?

- a) Primary
- b) Secondary
- c) Tertiary
- d) All have equal share

168. Narsimham Committee recommended to make banking structure of the country

- a) 2 tier
- b) 3 tier
- c) 4 tier
- d) 5 tier

169. Inflation in India is measured on the basis of which index ?

- a) Consumer Price Index
- b) Wholesale Price Index
- c) Retail Price Index
- d) Market forces

170. India's rank in World Happiness Index 2016 stands at

171. "Indradhanush Mission" launched by Indian Government in August 2015 is related to

- a) Tourism
- b) BSNL
- c) Foreign Trade
- d) Public Sector Bank

172. The Second Five Year Plan was made by

- a) B.N.Gadgil
- b) VKRV Rao
- c) P.C. Mahalanobis
- d) C.N. Vakil

173. Fourteenth Finance Commission has recommended what percentage share of States in the net proceeds of the Union Tax Revenues ?

- a) 40
- b) 42
- c) 45
- d) 48

174. The new Foreign Trade Policy has set a target of \$ _____ billion by 2020

- a) 850
- b) 875
- c) 900
- d) 950

175. India's rank in Global Hunger 2016 is

- a) 39th
- b) 80th
- c) 97th
- d) 100th

PART - C - STATISTICS

(OPTIONAL)

Marks : 200

Each question carries 2 marks :

76. A box contains 100 bolts and 50 nuts. It is given that 50% nuts are rusted. Two objects are selected from the box at random. Find the probability that both are bolts or both are rusted

- a) 0.50 b) 0.53
- c) 0.20 d) 0.58

77. A card is drawn from a well-shuffled deck of 52 cards. Find the probability of drawing a Jack, queen, king or an ace is

- a) $\frac{13}{52}$ b) $\frac{9}{13}$
- c) $\frac{4}{13}$ d) $\frac{23}{13}$

78. In a series of houses actually invaded by smallpox, 70% of the inhabitants are attacked and 85% have been vaccinated. What is the lowest percentage of the vaccinated that must have been attacked ?

- a) 63.1% b) 64.7%
- c) 62.4% d) 67.4%

79. The number of independent values in a set of value is known as

- a) Sample size b) Optimum
- c) Degrees of freedom d) None of the above

80. If ' β ' is the probability of type II error, the power of the test is

- a) $1 - \infty\beta$ b) $1 + \beta$
- c) $1 - \infty$ d) $1 - \beta$

81. What kind of test is applicable if the sample is less than 30 ?

- a) t-test b) F-test
- c) chi-square test d) z-test

82. The value of χ^2 (chi-square) ranges from

- a) 0 to 1 b) 0 to ∞
- c) 1 to ∞ d) ∞ to $-\infty$

83. When a χ^2 (chi-square) statistic will be zero?

- a) $O_i = e_i = j$ b) $O_i = e_i$

- c) $O_i = -e_i$ d) none of the above

84. Paired 't'-test is applicable only when the observation are

- a) paired b) not paired
- c) $N > 30$ d) none of the above

85. How many types of error are there in taking decision about H_0 ?

- a) one b) four
- c) five d) two

86. The range of F-statistic varies from

- a) $1 \infty 10$ b) 1 to ∞
- c) $-\infty$ to ∞ d) 0 to ∞

87. The theory of testing a hypothesis was first originated by

- a) Sir R.A. Fisher b) Lovitt
- c) Neyman d) none of the above

88. A numerical value used as a summary measure for a sample, such as sample mean, is known as a

- a) population parameter
- b) sample parameter
- c) sample statistic
- d) population mean

89. Since the population size is always larger than the sample size, then the sample statistic

- a) can never be larger than the population parameter
- b) can never be equal to the population parameter
- c) can never be zero
- d) None of the above answers is correct

90. The mean of a sample is

- a) always equal to the mean of the population
- b) always smaller than the mean of the population
- c) computed by summing the data values and dividing the sum by $(n - 1)$
- d) computed by summing all the data values and dividing the sum by the number of items

91. The sum of the percent frequencies for all

classes will always equal

- a) one
- b) the number of classes
- c) the number of items in the study
- d) 100

92. In a five number summary, which of the following is not used for data summarization ?

- a) the smallest value
- b) the 25th percentile
- c) the mean
- d) none of the above

93. Since the mode is the most frequently occurring data value, it

- a) none of the answers is correct
- b) is always larger than the median
- c) is always larger than the mean
- d) must have a value of at least two

94. A coin is tossed twice. What is the probability that at least one tails occur ?

- a) $\frac{1}{4}$
- b) $\frac{3}{4}$
- c) $\frac{1}{2}$
- d) 1

95. A letter is chosen at random from the word 'ASSASSINATION'. Find the probability that the letter is a vowel and consonants.

- a) $\frac{5}{13}, \frac{9}{13}$
- b) $\frac{3}{13}, \frac{7}{13}$
- c) $\frac{6}{13}, \frac{7}{13}$
- d) $\frac{6}{13}, \frac{8}{13}$

96. Two dice are thrown together. What is the probability that the sum of the numbers on the two faces is neither divisible by 3 or by 5 ?

- a) $\frac{13}{36}$
- b) $\frac{35}{36}$
- c) $\frac{17}{36}$
- d) $\frac{11}{36}$

97. Three unbiased coins are tossed once. Find the probability of getting at most 2 heads

- a) $\frac{7}{8}$
- b) $\frac{3}{8}$
- c) $\frac{3}{4}$
- d) $\frac{1}{2}$

98. A and B are two mutually exclusive events. If $P(A) = 0.5$ $P(B) = 0.6$. Find $P(A \text{ or } B)$.

- a) 0.11
- b) 0.9
- c) 0.7
- d) 0.6

99. A card is drawn from a well shuffled 52 cards. Find the probability that a card drawn is neither a ace card nor a red card.

- a) $\frac{48}{52}$
- b) $\frac{38}{52}$
- c) $\frac{15}{13}$
- d) $\frac{5}{13}$

100. The relationship between mean, median and mode is given as

- a) Mean - Median = 3(Mode - Mean)
- b) Mean - Mode = 3(Mean - Median)
- c) Mode = 3 Median - 4 Mean
- d) Median - Mean = 3(Mode - Mean)

101. The average weekly pocket money of 5 students in rupees are as follows 45, 50, 70, 30 and 55. Then the arithmetic mean is

- a) 55
- b) 48
- c) 56
- d) 50

102. A man drives a car at a speed of 30 kms/hr when he goes up hills. But when he drives downhill the speed is 60 kms/hour. Then the average speed of the car is

- a) 30 Km/hr
- b) 45 Km/hr
- c) 40 Km/hr
- d) 38 Km/hr

103. A variable takes the values 2, 4, 8, 16, ..., 2^n . Then its Arithmetic mean is

- a) $\frac{3(3^n - 1)}{n}$
- b) $\frac{2(2^n - 1)}{n}$
- c) $\frac{2(2^n - 1)}{2n}$
- d) $\frac{4(4^n - 1)}{n}$

104. 47, 50, 49, 70, 63, 55, 81 are the set of observations, then its range and co-efficient of range is

- a) 34, $\frac{34}{128}$
- b) 29, $\frac{29}{125}$
- c) 34, $\frac{29}{128}$
- d) 29, $\frac{34}{128}$

105. When one of the value is zero, then the geometric mean is

- a) not defined b) 1
c) 0 d) none of the above

106. In case of positively skewed distribution, what is the relation between mean, median and mode?

- a) Mode < Mean < Median
b) Mean > Mode > Median
c) Mean > Median > Mode
d) Median > Mode > Mean

107. If A and B are independent events, and

$$P(A) = \frac{2}{3}, P(B) = \frac{3}{5}, P(A \cup B) = \frac{13}{15}, \text{ then}$$

$P(\bar{A}/B)$ is

- a) $\frac{1}{5}$ b) $\frac{1}{3}$
c) $\frac{1}{2}$ d) $\frac{2}{5}$

108. If A_1 and A_2 are two independent events then $P(A_1 \cap A_2)$ is

- a) $P(A_1) P(A_2)$ b) $P(A_1 \cup A_2)$
c) $P(\bar{A}_1 \cup A_2)$ d) $P(A_2 \cap A_1)$

109. Which of the following is a continuous distribution?

- a) Binomial distribution
b) Poisson distribution
c) Normal distribution
d) none of the above

110. If the mean of the observation is 770 and its standard deviation is 110, then its co-efficient of variation is

- a) 13.50 b) 14.29
c) 15.50 d) 13.29

111. The average salary of male employees in a firm was Rs.5,200 and that of female was Rs.4,200. The mean salary of all the employees was Rs.5,000. Then the percentage of male and female employees is

- a) 70% and 30% b) 60% and 40%
c) 80% and 20% d) 90% and 10%

112. The first of the two samples has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15.6 and

standard deviation is $\sqrt{13.4}$, then the standard deviation of the second group is

- a) 6 b) 3.5
c) 4 d) 4.5

113. The probability of selecting any specified unit is included in the sample is given by

- a) $\frac{N}{n}$ b) $\frac{n}{N}$
c) N d) none of the above

114. From a class of 32 students, 4 are to be chosen for a competition. In how many ways this be done

- a) 34960 b) 35960
c) 36960 d) 35690

115. The mean deviation from the mean of 4, 7, 8, 9, 10, 12, 13, 17 is

- a) 2.5 b) 3.5
c) 3 d) 4

116. The variance of 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, is

- a) 35 b) 36
c) 39 d) 33

117. The relation between operators E and Δ within its usual sense in interpolation is

- a) $E = \Delta$ b) $1 - E = \Delta$
c) $E + 1 = \Delta$ d) $E - 1 = \Delta$

118. Five pairs of values of arguments and entries would determine

- a) First degree polynomial
b) Fourth degree polynomial
c) Fifth degree polynomial
d) None of the above

119. Lagrange's formula can be used for _____ interpolation also

- a) Inverse b) Forward
c) Backward d) None of the above

120. In Newton's backward formula, the origin of the value of the argument in the series is

- a) First b) Middle
c) Last d) None of the above

121. Mr. Anil was getting Rs.250/- and Rs.429/- in 1957. Calculate how much he ought to have

got an extra allowance in 1957 to maintain his pre-war standard of living if of living index number of 1957 with respect to 1939 is 365.95

- a) Rs.485.88 b) Rs.385.98
c) Rs.458.88 d) Rs.498.88

122. Which test of index number are satisfied by Fisher's ideal index number formula ?

- a) Average
b) Time reversal and factor reversal test
c) Forecasting
d) Circular

123. The Fisher's formula is generally known as

- a) Geometric mean
b) Consumer price index
c) Ideal formula
d) None of the above

124. In a certain distribution, the following result were obtained that mean = 45, median = 48, co-efficient of skewness = -0.5, then the values of standard deviation is

- a) 20 b) 16
c) 14 d) 18

125. The geometric mean of 3, 9, 27 is

- a) 9 b) 27
c) 3 d) None of the above

126. A, B and C are three arbitrary events. Which is the expression for occurrence of A only?

- a) $A \cap B \cap \bar{C}$ b) $A \cap \bar{B} \cap \bar{C}$
c) $A \cap B \cap C$ d) $A \cup B \cap C$

127. The geometric mean of a set of values lies between Arithmetic Mean (A.M) and

- a) Range b) Median
c) Quartile deviations d) Harmonic Mean

128. The arithmetic mean of two observations is 127.5 and the geometric mean is 60. Find the two observations

- a) 240, 15 b) 230, 20
c) 260, 30 d) 245, 15

129. Given that lines of regression of y on x and x on y are respectively $y = x$ and $4x - y - 3 = 0$. Calculate the mean for x and mean for y

- a) 1, 3 b) 1, 1
c) 2, 1 d) 5, 1

130. The range of partial regression co-efficient is

- a) 0 to 1 b) 0 to ∞
c) $-\infty$ to ∞ d) None of the above

131. For two attributes $\theta + 1$, what does it indicate ? (θ Is Yule's co-efficient of association)

- a) Two attributes are positively associated and it is the highest co-efficient of association.
b) Two attributes are negatively associated.
c) Two attributes are the least co-efficient of association.
d) None of the above

132. Two lines of regression become perpendicular if r is

- a) One b) Two
c) Zero d) None of the above

133. Four dice are thrown. Find the probability that the sum of numbers appearing will be 18

- a) $\frac{5}{81}$ b) $\frac{7}{81}$
c) $\frac{13}{29}$ d) $\frac{11}{81}$

134. The difference between statistic and parameter is called

- a) Random Error b) Sampling Error
c) Standard Error d) Error

135. In random sampling, the probability of selecting an item from the finite population is

- a) Unknown b) Undecided
c) Known d) Zero

136. In sampling with replacement a sampling unit can be selected

- a) Only once b) More than one time
c) Less than one time d) None of the above

137. Sample is a subset of

- a) Data b) Population
c) Itself d) Group

138. If we reject the true null hypothesis, we might be making

- a) Type-I-Error b) Type-II-Error
c) A correct decision d) Unpredictable

139. What is the probability of a type II Error when $\alpha = 0.05$?

- a) 0.025 b) 0.05
c) 0.95 d) cannot be determined

140. Efficiency of an estimate can be checked by comparing

- a) Mean b) Variance
c) Mean square d) Standard deviation

141. Analysis of variance (ANOVA) is also a test for equality of

- a) Variance b) Means
c) Proportions d) Only two parameters

142. If $P(A) = 0.8$, $P(B) = 0.7$ and $P(A/B) = 0.6$. What is $P(A \text{ and } B)$?

- a) 0.15 b) 0.42
c) 0.27 d) 0.15

143. Which of the following is a component of a linear programming model ?

- a) Constraints b) Decision Variables
c) Objective function d) All of the above

144. For the products P and q, which of the following could be a linear programming objective function ?

- a) $Z = p + 2q$ b) $Z = p - 2$
c) $Z = + 2 \frac{p}{q}$ d) All of the above

145. Ten coins are thrown simultaneously. Find the probability of getting at least seven heads.

- a) $\frac{176}{1024}$ b) $\frac{196}{1024}$
c) $\frac{167}{1024}$ d) None of the above

146. A and B play a game in which their chances are in the ratio 3 : 2. Find A's chance of winning at least three games out of the five games played.

- a) 0.24 b) 0.68
c) 0.33 d) 0.64

147. In a binomial distribution consisting of 5 independent trials, probabilities of 1 and 2 success are 0.4096 and 0.2048 respectively. Find the parameter 'p' of the distribution.

- a) 0.1 b) 0.5
c) 0.2 d) None of the above

148. The mean and variance of binomial distribution are 4 and $\frac{4}{3}$ respectively. Find $P(X \geq 1)$

149. In a book of 520 pages, 390 typo-graphical errors occur. Assuming Poisson Law for the number of errors per page, find the probability that a random sample of 5 pages will contain no error.

- a) 0.99863 b) 0.91969
c) 0.89943 d) 0.93675

150. X is normally distributed and the mean of X is 12 and S.D. is 4. Find the probability of $P(X \geq 20)$. Given $P(Z = 2) = .4772$

- a) $e^{-3.75}$ b) $e^{3.75}$
c) $e^{2.73}$ d) None of the above

151. The mean yield for one-acre plot is 662 kilos with a s.d. 32 kilos. Assuming normal distribution, how many one-acre plots in a batch of 1000 plots would you expect to have yield (i) over 700 kilos (ii) below 650 kilos ?

- a) 185, 275 b) 117, 352
c) 98, 311 d) None of the above

152. Given the following two constraint, which solution is a feasible solution for maximization : Constraints 1 : $4x + 3y \leq 18$
Constraints 2 : $x - y \leq 3$

- a) $(x, y) = (1, 5)$ b) $(x, y) = (4, 1)$
c) $(x, y) = (4, 0)$ d) $(x, y) = (2, 1)$

153. A constraint is a mathematical relation in which

- a) A variable representing the decision not to be made.
b) An inequality or equality that restricts the values of the decision variables.
c) A measure of the performance of the model.
d) The sales of forecasts.

154. The part of a linear programming model that express what needs to be either maximizes or minimized depending upon the objective of the problem is called

- a) Objective function b) Constraints
c) Feasible solution d) None of the above

155. A linear programming model given below :
Maximize $Z = x + 2y$

Subject to : $x + y \leq 5$
 $x + 3y \leq 9$

What is the objective function value if $(x, y) = (3, 1)$ used as a possible solution ?

- a) 4 b) 5
 c) 7 d) None of the above

156. The dividing lines between random and non-random deviations from mean of the distributions are known as

- a) Upper control limit b) Lower control limit
 c) Control limits d) Two sigma limits

157. The control chart used for the fraction of defective items in a sample is

- a) Range chart b) Mean chart
 c) p - chart d) c - chart

158. Central tendency of a process is monitored in

- a) Range chart b) Mean chart
 c) p - chart d) c - chart

159. The process capability to calculate as

- a) $(USL - LSL)/3\sigma$ b) $(USL + LSL)/3\sigma$
 c) $(USL - LSL)/6\sigma$ d) $(USL + LSL)/6\sigma$

[Where USL = upper specification limit
 LSL = lower specification limit]

160. Find the expectation of a discrete random variable x whose p.m. f(probability mass function) is given by $f(x) = \left(\frac{1}{2}\right)^x$ for $x = 1, 2, 3,$

- a) 0 b) 3
 c) 1 d) 1.38

161. Find out standard deviation from the following data

- 5, 8, 7, 11, 9, 10, 8, 2, 4 and 6
 a) 2.01 b) 3.25
 c) 2.65 d) None of the above

162. Given that $(A) = 90$, $(AB) = 40$, $N = 150$ and $(b) = 80$, then the value of (a) , (ab) , (AB) and (aB) are

- a) 60, 30, 50, 30 b) 40, 30, 50, 30
 c) 60, 70, 50, 30 d) 70, 60, 40, 30

163. For two attributes, $\theta = -1$, what does it indicate (θ is yules co-efficient of association)

- a) Positively associated

- b) Completely disassociated
 c) Negatively associated
 d) None of the above

164. Two lines of regression become perpendicular if 'r' is

- a) 1 b) -1
 c) 0 d) ∞

165. Calculate the median from the following data

- 57, 58, 61, 42, 38, 65, 72, 66
 a) 59.5 b) 49.3
 c) 42 d) 38

166. If X and Y are two random variables having joint density function

$$F(x,y) = \begin{cases} \frac{1}{8}(6-x-y); 0 \leq x < 2, 2 \leq y < 4 \\ 0, \text{ otherwise} \end{cases}$$

Find $P(x < 1 \cap y < 3)$

- a) $\frac{8}{3}$ b) $\frac{3}{8}$
 c) $\frac{3}{7}$ d) None of the above

167. An Urn contains 7 white and 3 red balls. Two balls are drawn together, at random from this urn. Compute the probability that neither of them is white. Find also the probability of getting one white and one red ball. Hence, compute the expected number of white balls drawn is

- a) $\frac{13}{15}$ b) $\frac{21}{15}$
 c) $\frac{3}{5}$ d) None of the above

168. A Box contains 'a' white and 'b' black balls. 'c' balls are drawn at random. Find the expected value of the number of white balls drawn.

- a) $\frac{c}{a+b}$ b) $\frac{b}{a+b}$
 c) $\frac{ca}{a+b}$ d) $\frac{ab}{a+b}$

169. Find the mean and variance with probability function

$$f(x) = \frac{2}{3} \left(\frac{1}{3} \right)^{x-1} \text{ for } x = 1, 2, 3, \dots$$

$$= 0, \text{ otherwise}$$

- a) $\frac{3}{2}, \frac{27}{4}$ b) $\frac{2}{3}, \frac{27}{4}$
 c) $\frac{2}{27}, \frac{3}{4}$ d) None of the above

170. Five fair coins are tossed. Find the probability of exactly three heads.

- a) $\frac{5}{13}$ b) $\frac{5}{16}$
 c) $\frac{10}{13}$ d) $\frac{23}{16}$

171. If $X \sim B$ in $(10, 0.6)$, then find $E(x^2)$

- a) 37.4 b) 33.7
 c) 38.4 d) None of the above

172. If $f(x)$ is a p.d.f (probability density function) of a random variable x , defined as

$$f(x) = Cx, \quad 1 \leq x \leq 2$$

$$= C, \quad 2 \leq x \leq 3$$

Then, the value of C is

- a) $\frac{2}{5}$ b) $\frac{1}{5}$
 c) $\frac{5}{2}$ d) $\frac{3}{7}$

173. The value of $\Delta \log f(x)$ is

- a) $\frac{\log f(x)}{\log f(x+h)}$ b) $\frac{\log f(x+h)}{\log f(x)}$
 c) $\log f(x)$ d) None of the above

174. Measures of dispersion can be broadly classified into how many categories :

- a) One b) Four
 c) Two d) None of the above

175. Standard deviation is also termed as

- a) Root mean square deviation
 b) Central value
 c) Step-deviation method
 d) None of the above
