

V12BM

Virudhunagar District Common Examinations
Common Half Yearly Examination - December 2022

Standard 12

BUSINESS MATHEMATICS AND STATISTICS

Time: 3.00 Hrs.

Marks: 90

PART - A

(i) Choose the best answers. (ii) Answer all the questions. $20 \times 1 = 20$

- 1) In a transition probability matrix, all the entries are greater than or equal to
a) 2 b) 1 c) 0 d) 3
- 2) The system of equations $4x+6y = 5$, $6x+9y = 7$ has
a) a unique solution b) no solution
c) infinitely many solutions d) none of these
- 3) $\int \frac{e^x}{\sqrt{1+e^x}} dx$ is
a) $\frac{e^x}{\sqrt{1+e^x}} + c$ b) $2\sqrt{1+e^x} + c$ c) $\sqrt{1+e^x} + c$ d) $e^x\sqrt{1+e^x} + c$
- 4) $\Gamma(1)$ is
a) 0 b) 1 c) n d) n!
- 5) The demand function for the marginal function $MR = 100-9x^2$ is
a) $100-3x^2$ b) $100x-3x^2$ c) $100x-9x^2$ d) $100+9x^2$
- 6) If the marginal revenue of a firm is constant, then the demand function is
a) MR b) MC c) $C(x)$ d) AC
- 7) The integrating factor of $x \frac{dy}{dx} - y = x^2$ is
a) $\frac{-1}{x}$ b) $\frac{1}{x}$ c) $\log x$ d) x
- 8) The degree of the differential equation $\frac{d^4 y}{dx^4} - \left(\frac{d^2 y}{dx^2}\right)^4 + \frac{dy}{dx} = 3$.
a) 1 b) 2 c) 3 d) 4
- 9) If $h = 1$, then $\Delta(x^2) =$
a) $2x$ b) $2x-1$ c) $2x+1$ d) 1
- 10) If $f(x) = x^2+2x+2$ and the interval of differencing is unity then $\Delta f(x)$
a) $2x-3$ b) $2x+3$ c) $x+3$ d) $x-3$
- 11) If c is a constant, then $E(c)$ is
a) 0 b) 1 c) $cf(c)$ d) C
- 12) $E[x-E(x)]^2$ is
a) $E(x)$ b) $E(x^2)$ c) $V(x)$ d) $SD(x)$
- 13) In a parametric distribution for the mean is equal to variance is
a) binomial b) normal c) poisson d) all the above
- 14) In a binomial distribution, the probability of success is twice as that of failure. Then out of 4 trials, the probability of no success is
a) $16/81$ b) $1/16$ c) $2/27$ d) $1/81$
- 15) A finite subset of statistical individuals in a population is called
a) a sample b) a population
c) universe d) census
- 16) _____ is a relative property, which states that one estimates is efficient relative to another.
a) Efficiency b) Sufficiency c) Unbiased d) Consistent

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- 17) Least square method of fitting a trend is
 a) Most exact
 b) Least exact
 c) Full of subjectivity
 d) Mathematically unsolved
- 18) Variations due to natural disorder is known as
 a) random cause
 b) non random cause
 c) human cause
 d) all of these
- 19) If number of sources is not equal to number of destinations, the assignment problem is called _____.
 a) balanced
 b) unsymmetric
 c) symmetric
 d) unbalanced
- 20) In an assignment problem involving four workers and three jobs, total number of assignment possible are
 a) 4
 b) 3
 c) 7
 d) 13

PART - B

(i) Answer any seven questions. (ii) Qn.No. 30 is compulsory. **7×2=14**

21) Solve the equations $2x+3y = 7$, $3x+5y = 9$ by Cramer's rule.

22) Evaluate: $\int_0^1 (x^3 + 7x^2 - 5x) dx$

23) When the Elasticity function is $\frac{x}{x-2}$, find the function when $x = 6$ and $y = 16$.

24) Solve: $9y''+12y'+4y = 0$

25) Evaluate: $\Delta(\log ax)$

26) A continuous random variable X has the following pdf $f(x) = ax$, $0 \leq x \leq 1$.

Determine the constant 'a' and also find $P\left(X \leq \frac{1}{2}\right)$.

- 27) A pair of dice is thrown 4 times. If getting doublet is considered a success, find the probability of 2 successer.
- 28) A die is thrown 9000 times and a throw of 3 or 4 is observed 3240 times. Find the standard error of the proportion for an unbiased die.
- 29) Construct the cost of living index number for 2011 on the basis of 2007 from the given data using family budget method.

Commodities	Price		Weights
	2007	2011	
A	350	400	40
B	175	250	35
C	100	115	15
D	75	105	20
E	60	80	25

- 30) A business man has three alternatives open to him each of which can be followed by any of the four possible events the conditional pay offs for each action event combination one given below.

Alternative	Pay-offs (conditional events)			
	A	B	C	D
X	8	0	-10	6
Y	-4	12	18	-2
Z	14	6	0	8

Determine which alternative should the businessman choose, if he selects the maximin principle.

PART - C

(i) Answer any seven questions. (ii) Qn.No. 40 is compulsory. **7×3=21**

31) Find K, if the equations $x+y+z = 7$, $x+2y+3z = 18$, $y+kz = 6$ are inconsistent.

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- 32) Evaluate: $\int \frac{1}{\sqrt{x+2} - \sqrt{x-2}} dx$
- 33) Using integration find the area of the circle whose centre is at origin and the radius is 'a' units.
- 34) Find the differential equation corresponding to $y = ae^{4x} + be^{-x}$ where a, b are arbitrary constants.
- 35) If $h = 1$ then prove that $(E^{-1}\Delta)x^3 = 3x^2 - 3x + 1$.
- 36) Assume the mean height of children to be 69.25 cm with a variance of 10.8 cm. How many children in a school of 1200 would you expect to be over 74 cm tall?
- 37) The mean weekly sales of soap bars in departmental stores were 146.3 bars per store. After an advertising campaign the mean weekly sales in 400 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2 was the advertising campaign successful at 95% confidence limit?
- 38) Calculate three yearly moving averages of number of students studying in a higher secondary school in a particular village from the following data.

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
No. of students	332	317	357	392	402	405	410	427	435	438

- 39) Solve the following assignment problem.

		Men		
		1	2	3
Task	P	9	26	13
	Q	13	27	6
	R	35	20	15
	S	18	30	20

- 40) The time to failure in thousands of hours of an important piece of electronic equipment used in a manufactured DVD player has the density function.

$$f(x) = \begin{cases} 3e^{-3x}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

Find the expected life of the piece equipment.

PART - D

Answer all the questions:

7×5=35

- 41) a) Investigate for what values of 'a' and 'b' the following system of equations $x+y+z = 6$, $x+2y+3z = 10$, $x+2y+az = b$ have (i) no solution (ii) a unique solution (iii) an infinite number of solutions.

(OR)

- b) Estimate the production for 1964 and 1966 from the following data:

Year	1961	1962	1963	1964	1965	1966	1967
Production	200	220	260	-	350	-	430

- 42) a) A total of Rs. 8,500 was invested in three interest earning accounts. The interest rates were 2%, 3% and 6% if the total simple interest for one year was Rs. 380 and the amount invested at 6% was equal to the sum of the amounts in the other two accounts, then how much was invested in each account?
(OR)
- b) Time taken by a construction company to construct a flyover is a normal variate with mean 400 labour days and standard deviation of 100 labour days. If the company promises to construct the flyover in 930 days or less and agree to pay a penalty of Rs. 10,000 for each labour day spent in excess of 450 days. What is the probability that
- The company pays a penalty of atleast Rs. 2,00,000?
 - The company takes atmost 500 days to complete the flyover?

43) a) Evaluate the integral as the limit of a sum $\int_1^2 (2x+1) dx$.

(OR)

- b) i) A sample of 900 members has a mean 3.4 cm and SD 2.61 cm. Is the sample taken from a large population with mean 3.25 cm and SD 2.62 cm? (95% confidence limit)
 ii) If the population is normal and its mean is unknown, find the 95% and 98% confidence limits of true mean.
- 44) a) The demand and supply function of a commodity are $P_d = 18 - 2x - x^2$ and $P_s = 2x - 3$. Find the consumer's surplus and producer's surplus at equilibrium price.
 (OR)
 b) Given below are the data relating to the production of sugarcane in a district. Fit a straight line trend by the method of least squares and tabulate the trend values.

Year	2000	2001	2002	2003	2004	2005	2006
Production of sugarcane	40	45	46	42	47	50	46

45) a) Suppose that the quantity demanded $Q_d = 13 - 6p + 2 \frac{dp}{dt} + \frac{d^2p}{dt^2}$ and quantity supplied $Q_s = -3 + 2p$. Where p is the price. Find the equilibrium price for market clearance.
 (OR)

- b) Find a polynomial of degree two which takes the values.

x	0	1	2	3	4	5	6	7
y	1	2	4	7	11	16	22	29

46) a) A random variable X has the following probability function.

X	0	1	2	3	4	5	6	7
P(x)	0	a	2a	2a	3a	a ²	2a ²	7a ² +a

(i) Find a , Evaluate (ii) $P(X < 3)$ (iii) $P(X > 2)$ and (iv) $P(2 < X \leq 5)$.

(OR)

- b) The distribution of the number of road accidents per day in a city is poisson with mean 4. Find the number of days out of 100 days when there will be (i) no accident (ii) atleast 2 accidents and (iii) atmost 3 accidents.
- 47) a) Compute (i) Laspayre's (ii) Paasche's (iii) Fisher's index numbers for the 2010 from the following data.

Commodities	Price		Quantity	
	2000	2010	2000	2010
A	12	14	18	16
B	15	16	20	15
C	14	15	24	20
D	12	12	29	23

(OR)

- b) Obtain an initial basic feasible solution to the following transportation problem by north west corner method.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Required	200	225	275	250	