GOVERNMENT OF KARNATAKA
DEPARTMENT OF PRE-UNIVERSITY EDUCATION
II YEAR PUC ANNUAL EXAMINATION – APRIL/ MAY 2022
SCHEME OF VALUATION

Subject code: 31(NS) **Subject: STATISTICS**

Q. NO.	**I.** **SECTION – A**	MARKS
1.	Registration method or Census method	1
2.	Cohort is a group of individuals who are born at the same time and who experience the same mortality conditions.	1
3.	Base year prices (p_0)	1
4.	CPI (AEM) = $\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}$ x 100	1
5.	Graphical representation of time series data.	1
6.	Increase in the price of gold in the past many years. (Any one)	1
7.	Variance = 0.16	1
8.	Mean = 9	1
9.	Mean = 0	1
10.	A statistical constant of the population.	1
11.	If an interval is proposed as an estimate of the unknown parameter.	1
12.	The probability of rejecting null hypothesis, when it is not true.	1
13.	$\overline{x}$ -chart or R-chart	1
14.	$\Sigma a_i = \Sigma b_j$	1
15.	The strategy of a player is the pre-determined rule by which a player determines his course of action.	1

Q.NO.	**II.** **SECTION - B**	MARKS
16.	(i) They are used in medical research. (ii) They are used in actuarial science. (Any two)	1 1
17.	$e_1 = \frac{T_1}{l_1}$ $e_1 =$ **64** years	1 1
18.	(i) It satisfies both TRT and FRT. (ii) It is free of bias. (Any two)	1 1
19.	$Q_{01}(P) = \frac{\Sigma p_1 q_1}{\Sigma p_1 q_0} \times 100$ = **98.113**	1 1
20.	CLI(FBM) = $\frac{\Sigma WP}{\Sigma W}$ = **105**	1 1
21.	(i) Graphical method. (ii) Semi-averages method. (Any two)	1 1
22.	a) Seasonal variation. b) Irregular variation.	1 1
23.	(i) The value of the independent variable should have a common difference. (ii) The value of X, for which the value of Y is to be interpolated must be one of the values of X.	1 1
24.	(i) Mean = p (ii) Variance = pq (Any two)	1 1
25.	Median = **0** S.D. = **1.118**	1 1
26.	S.E.($\bar{x}_1 - \bar{x}_2$) = $\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$ = **3**	1 1
27.	The error that occurs by rejecting null hypothesis when it is actually true is called type – I error. The error that occurs by accepting null hypothesis when it is actually not true is called type – II error.	1 1
28.	U.C.L. = $\bar{\bar{X}} + A_2\bar{R}$ = **41.443**	1 1
29.	Number of positive allocations (4) < m+n-1 (5) ∴ The solution is degenerate.	1 1
30.	(i) Holding cost (C_1) (ii) Set-up cost (C_3) (Any two)	1 1

Q.NO.	**III.** **SECTION – C**	MARKS
31.	GFR = $\frac{\text{Number of Live births during a year}}{\text{Total number of women of child bearing age in the year}}$ x 1000 = $\frac{874}{9100}$ x 1000 = **96.044** ASFR = $\frac{\text{Number of Live births in a specified age group in a year}}{\text{Total number of females in that particular age group in a year}}$ X 1000 ASFR [25-29] = **200** ASFR [30-34] = **100**	1 1 1 1 1
32.	WSFR = $\frac{\text{No.of Female births in a specified age group in a year}}{\text{Total no.of females in that particular age group in a year}}$ x 1000 WSFR: 25 40 25 25 10 10 2.5 WSFR X S: 22.5 36 22.5 21.25 8.5 7.5 1.75 Σ WSFR X S = **120** NRR = i x Σ WSFR x S = 5 x 120 = **600**	1 1 1 1 1
33.	(i) Defining the purpose of index number. (ii) Selection of base period. (iii) Selection of items. (iv) Obtaining price quotations. (v) Choice of an average. (Any five)	1 1 1 1 1
34.	p_1q: 330 324 49 100 Σp_1q = **803** p_0q: 225 240 28 50 Σp_0q = **543** $P_{01}^{(K)} = \frac{\Sigma p_1 q}{\Sigma p_0 q}$ x 100 = **147.88** Conclusion: Level of price increased by 47.88% in the current year.	1 1 1 1 1
35.	5-yearly moving sums: 89 109 127 149 178 5-yearly moving averages: 17.8 21.8 25.4 29.8 35.6 Position of trend values	2 2 1
36.	Table and n = 5, Σy = 400, Σx = 0, Σx^2 = 10, Σxy = 52 $a = \frac{\Sigma y}{n} = \frac{400}{5}$ = **80** $b = \frac{\Sigma xy}{\Sigma x^2} = \frac{52}{10}$ = **5.2** The trend equation is, y = 80 + 5.2(x)	2 1 1 1
37.	Table and x_0 =20, y_0 = 53, Δ_0^1 = -4, Δ_0^2 = -9, Δ_0^3 = 9 $x = \frac{25-20}{10}$ = **0.5** $y_x = y_0 + x\Delta_0^1 + \frac{x(x-1)}{2!}\Delta_0^2 + \frac{x(x-1)(x-2)}{3!}\Delta_0^3$ y_{25} = **52.688**	2 1 1 1
38.	n = 5, p = 0.4, q = 0.6, $p(x) = {}^5C_x (0.4)^x (0.6)^{5-x}$, x =0,1,2,3,4,5. a) $p(0) = {}^5C_0 (0.4)^0 (0.6)^{5-0}$ = **0.0778** b) $p(5) = {}^5C_5 (0.4)^5 (0.6)^{5-5}$ = **0.0102**	1 1 1 1 1

39.	Mean, $E(x) = \frac{na}{a+b}$ $= \mathbf{1.6364}$ Variance, $V(x) = \frac{nab(a+b-n)}{(a+b)^2(a+b-1)}$ $= \frac{6x3x8\ (5)}{(11)^2\ (10)}$ $= \mathbf{0.595}$	1 1 1 1 1
40.	H_0: $\mu = 30$ and H_1: $\mu < 30$ $Z_{cal} = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$ $= \mathbf{-2.7999}$ $k = -2.33$ $\therefore H_0$ is rejected.	1 1 1 1 1
41.	H_0: $\mu_1 = \mu_2$ and H_1: $\mu_1 \neq \mu_2$ $t = \frac{\bar{x}_1-\bar{x}_2}{\sqrt{\frac{n_1s_1^2+n_2s_2^2}{n_1+n_2-2}\left(\frac{n_1+n_2}{n_1n_2}\right)}}$ $= \mathbf{2.7933}$ d.f. = 17, k = ±2.11 $\therefore H_0$ is rejected.	1 1 1 1 1
42.	H_0: ‘smoking’ and ‘literacy’ are independent. H_1: ‘smoking’ and ‘literacy’ are not independent. $\chi^2 = \frac{N(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)}$ $= \mathbf{3}$ d.f. = 1, $k_2 = 3.84$ $\therefore H_0$ is accepted.	 1 1 1 1 1
43.	CL = $n\bar{p}$ = 50 x 0.05 = **2.5** LCL = $n\bar{p} - 3\sqrt{n\bar{p}\bar{q}}$ $= \mathbf{-2.1233}$ UCL = $n\bar{p} + 3\sqrt{n\bar{p}\bar{q}}$ $= \mathbf{7.1233}$	1 1 1 1 1
44.	Co-ordinates: (0,4), (4,0) and (0,6), (3,0) Drawing two lines. Identification of F.R. and its corner points: A(0,0), B(0,4), C(2,2), D(3,0) Objective function values: $Z_A = 0$, $Z_B = 40$, $Z_C = 26$, $Z_D = 9$ Maximum value of Z = **40** and optimal solution: x = **0** & y = **4** **(For visually challenged students only)** Steps for solving LPP graphically.	1 1 1 1 1 5
45.	Player B $\begin{array}{cccccc} & & B_1 & B_2 & B_3 & B_4 \\ \text{Player A} & A_1 & \boxed{\enclose{circle}{0}} & \boxed{5} & \boxed{4} & \boxed{2} \\ & A_2 & -1 & 0 & -2 & \enclose{circle}{-3} \\ & A_3 & \enclose{circle}{-3} & 1 & \enclose{circle}{-3} & 0 \end{array}$ Best strategy for player A is A_1. Best strategy for player B is B_1. The value of the game v = 0. $\therefore$ The game is fair.	2 1 1 1

Q. NO.	IV. SECTION – D	MARKS
46.	ASDR = $\frac{\text{Number of deaths in a specific age group in a year}}{\text{Total population in that age group in a year}}$ x 1000 ASDR(A) : 9 4 10 19 ASDR(B): 10 5 12 20 PA: 1,35,000 1,00,000 4,00,000 1,90,000 ΣPA = **8,25,000** PB: 1,50,000 1,25,000 4,80,000 2,00,000 ΣPB = **9,55,000** ΣP = 90,000 $STDR_A = \frac{\Sigma PA}{\Sigma P}$ and $STDR_B = \frac{\Sigma PB}{\Sigma P}$ STDR(A) = **9.1667** STDR(B) = **10.611** Interpretation: Locality A is healthier.	1 1 1 1 1 1 1 1 1 1
47.	p_1q_0: 200 300 96 40 $\Sigma\, p_1q_0$ = **636** p_0q_0: 160 200 80 40 $\Sigma\, p_0q_0$ = **480** p_1q_1: 200 240 72 45 $\Sigma\, p_1q_1$ = **557** p_0q_1: 160 160 60 45 $\Sigma\, p_0q_1$ = **425** $P_{01}^{(L)} = \frac{\Sigma p_1q_0}{\Sigma p_0q_0} \times 100$ = **132.5** $P_{01}^{(P)} = \frac{\Sigma p_1q_1}{\Sigma p_0q_1} \times 100$ = **131.06** $P_{01}^{(DB)} = \frac{P_{01}(L) + P_{01}(P)}{2}$ = **131.78**	1 1 1 1 1 1 1 1 1 1
48.	p_1q_0: 90 150 135 24 $\Sigma\, p_1q_0$ = **399** p_0q_0: 60 120 90 16 $\Sigma\, p_0q_0$ = **286** p_1q_1: 75 150 81 48 $\Sigma\, p_1q_1$ = **354** p_0q_1: 50 120 54 32 $\Sigma\, p_0q_1$ = **256** $P_{01}^{(F)} = \sqrt{\frac{\Sigma p_1q_0}{\Sigma p_0q_0} X \frac{\Sigma p_1q_1}{\Sigma p_0q_1}} \times 100$ = **138.89** According to TRT, P_{01} X P_{10} = 1 $P_{01}^{F} X P_{10}^{F} = \sqrt{\frac{399}{286} X \frac{354}{256}} X \sqrt{\frac{256}{354} X \frac{286}{399}} = 1$ According to FRT, $P_{01} X Q_{01} = \frac{\Sigma p_1q_1}{\Sigma p_0q_0}$ (V_{01}) $P_{01}^{F} X Q_{01}^{F} = \sqrt{\frac{399}{286} X \frac{354}{256}} X \sqrt{\frac{256}{286} X \frac{354}{399}} = \sqrt{\frac{354^2}{286^2}} = \frac{354}{286} = \frac{\Sigma p_1q_1}{\Sigma p_0q_0}$	1 1 1 1 1 1 1 1 1 1
49.	Table and n=5, Σx= 0, Σy=3550, Σx^2=10, Σx^3=0, Σx^4= 34, Σxy=1410, Σx^2y=7310 By substituting and solving the normal equations, **a = 680**, **b = 141** and **c = 15** The second degree trend is: y = 680 + 141(x) + 15(x^2)	6 1+1+1 1
50.	N = 325, λ = 0.44 p(0) = $e^{-0.44}$ = 0.644 or E(0) = 325 x 0.644 = 209.3 E: 209 92 20 3 1 H_0:Poisson distribution is a good fit. H_1:Poisson distribution is not a good fit. $\chi^2 = \sum \frac{(O-E)^2}{E}$ = **0.0626** d.f. = 1 , k_2 = 3.84 $\therefore$ H_0 is accepted.	1 1 3 1 1 1 1 1

Q. NO.	**V.** **SECTION – E**	MARKS
51.	$\mu = 64$, $\sigma = 12$, $Z = \frac{x-\mu}{\sigma}$ is a S.N.V. a) $P(X \geq 67) = P(Z \geq 0.25)$ $= \mathbf{0.4013}$ b) $P(X < 62) = P(Z < -0.17)$ $= \mathbf{0.4325}$	1 1 1 1 1
52.	$H_0: P = 0.5$ and $H_1: P \neq 0.5$ $Z = \frac{p-P_0}{\sqrt{\frac{P_0Q_0}{n}}}$ $= \mathbf{3.164}$ $k = \pm1.96$ ∴ H_0 is rejected.	1 1 1 1 1
53.	$H_0: \sigma^2 = 2.5$ and $H_1: \sigma^2 \neq 2.5$ $\chi^2_{cal} = \frac{ns^2}{\sigma_0^2}$ $= \mathbf{14.4}$ d.f. = 24, k_1 =9.89 and k_2 = 45.6 ∴ H_0 is accepted.	1 1 1 1 1
54.	P – S_n: 2000 2500 3000 3500 4000 ΣC_i : 100 300 630 1140 2000 T(n) : 2100 2800 3630 4640 6000 A(n) : 2100 1400 1210 **1160** 1200 ∴ The optimum replacement period, n = **4** years.	1 1 1 1 1
55.	R = 7000 $C_1 = 10$ $C_2 = 3$ $C_3 = 300$ a) $Q^0 = \sqrt{\frac{2C_3R}{C_1}}\sqrt{\frac{C_1+C_2}{C_2}}$ = **1349** units. b) $C(Q^0,S^0) = \sqrt{2C_1C_3R}\sqrt{\frac{C_2}{C_1+C_2}}$ = **Rs 3113.45**/year.	1 1 1 1 1

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