GOVERNMENT OF KARANATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

II Year PUC Supplementary Examination May/June – 2023

Scheme of Evaluation

Subject: Statistics Subject Code: 31

Q. No.	**SECTION - A**		Marks
I. 1	b) 25		1
2	b) 100		1
3	c) Mean = Variance		1
4	b) Type I-Error		1
5	d) 0		1
II. 6	i) Infant	e) Child aged less than one year	1
	ii) Current year weight	a) Paasche's price index number	1
	iii) Bernoulli Distribution	b) Range: 0,1	1
	iv) Parameter	c) Population constant	1
	v) Least cost entry method	d) Transportation problem	1
III.7	Ideal		1
8	6		1
9	Rejected		1
10	np		1
11	Saddle		1
IV.12	Fecundity refers to "the capacity of woman to bear children".		1
13	Retail (Consumer) price		1
14	War/flood/strike (Any such related factor)		1
15	1/2		1
16	A set of real values of $x_1, x_2, \ldots, x_n$ which satisfy the constraints AX (≤ = ≥) b is called a solution to L.P.P.		1

SECTION– B

V.17	$L_{01}^{P} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = 120$	1+1
18	Prosperity, Decline, Depression, Recovery	1+1
19	Binomial expansion method, Newton's advancing difference method	1+1
20	Mean = np = 2 Variance = npq = 1.2	1 1
21	One tailed test is a test of statistical hypothesis, where the rejection region will be located at only one tail of the probability curve. Two tailed test is a test of statistical hypothesis, where the rejection regions will be located at both the tails of the probability curve.	1 1
22	$S.E(p) = \sqrt{\frac{PQ}{n}} = 0.0571$	1+1
23	LCL = $\lambda' - 3\sqrt{\lambda'}$, UCL = $\lambda' + 3\sqrt{\lambda'}$	1+1
24	$Q^0 = \sqrt{\frac{2C_3R}{C_1}} = \sqrt{\frac{2(50)(3600)}{4}} = 300$ units/cycle.	1+1

SECTION – C

VI.25	ASFR formula or $\frac{1000}{50000} \times 1000$: 20, 110, 174, 125, 30, 8, 3 : 470 TFR = i $\sum$ ASFR = 5 × 470 = 2350.	1+2 1+1
26	1) Defining (stating) the purpose of the index number. 2) Selection of base period. 3) Selection of commodities. 4) Obtaining price quotations. 5) Choice of an average. 6) Selection of weights. 7) Selection of suitable formula. (Any Five)	5 (1 mark each)
27	p_0q: 80, 300, 675, 1250, 650 : $\sum p_0q = 2955$ p_1q: 160, 360, 900, 2000, 975 : $\sum p_1q = 4395$ $P_{01}^{K} = \frac{\sum p_1 q}{\sum p_0 q} \times 100 = 148.73$, There is 48.73% increase in the price of items in the current year.	1 1 1+1 1
28	Year(Position): 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 3Y.M.Sums : - 54 60 66 75 87 101 114 129 - Trend values : - 18 20 22 25 29 33.67 38 43 -	1 2 2
29	Formula + Substitution + Ans $(y_4 - 4y_3 + 6y_2 - 4y_1 + y_0 = 0 \Rightarrow y_2 = 6.25)$ Formula + Ans $(y_5 - 4y_4 + 6y_3 - 4y_2 + y_1 = 0 \Rightarrow y_5 = 23.75)$	1+1+1 1+1
30	$\lambda = 2$, $p(x) = \frac{e^{-\lambda}\lambda^x}{x!}$, X = 0, 1, 2, … (i) $p(x = 3) = \frac{e^{-2}2^3}{3!} = 0.1804$ (ii) $p(x < 2) = p(0) + p(1) = e^{-\lambda} + 2\,e^{-\lambda} = 0.4059$	1 1+1 1+1
31	Mean = $\frac{na}{a+b} = 0.75$ Variance = $\frac{nab(a+b-n)}{(a+b)^2(a+b-1)} = 0.5033$	1+1 1+1+1
32	H_0: The average weight of the school children is 30kg ($\mu = 30$) and H_1: $\mu < 30$. Test statistic $Z_{cal} = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{29-30}{5/\sqrt{64}} = -1.6$ k = -2.33, Here, Z_{cal} lies in acceptance region. ∴ accept H_0	1 1+1+1 1
33	H_0: Coaching does not show an improvement and H_1: $\mu_1 < \mu_2$. $d = x_1 - x_2$: -12, 2, -10, -9, -5 : -34 = $\sum d$ d^2 : 144, 4, 100, 81, 25 : 354 = $\sum d^2$ Here, $\bar{d} = \frac{\sum d}{n} = \frac{-34}{5} = -6.8$ and $s_d = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2} = 4.9558$ Test statistic $t_{cal} = \frac{\bar{d}}{s_d/\sqrt{n-1}} = -2.7443$ d.f = 4, k = - 2.13, Here, t_{cal} lies in rejection region. ∴ reject H_0	1 1 1+1 1
34	$\bar{p} = \frac{\sum d}{nk} = \frac{28}{1000} = 0.028$, ∴ $CL = n\bar{p} = 2.8$ U.C.L = $n\bar{p} + 3\sqrt{n\bar{p}\bar{q}} = 2.8 + 3\sqrt{100(0.028)(0.972)} = 7.7492$ L.C.L = $n\bar{p} - 3\sqrt{n\bar{p}\bar{q}} = 2.8 - 3\sqrt{100(0.028)(0.972)} = -2.1492 \cong 0$	1 1+1 1+1
35	$X_{11} = 50$, $X_{12} = 10$, $X_{22} = 70$, $X_{33} = 80$. T C = $\sum C_{ij}X_{ij}$ = 8(50) + 7(10) + 8(70) + 5(80) = 1430	3 2
36	Row minimums (1, 0, 4)/Column maximums (7, 5, 4, 5) Columns maxima 4/Row minima 4 Maximin = Minimax = 4 = Value of the game Best strategies are A_3, B_3	1 1 1+1 1

SECTION - D

VII.37	ASDR formula / showing one calculation A : 9, 4, 10, 30 PA : 18000, 12000, 60000, 120000 : $\sum PA = 2,10,000$ B : 10, 5, 12, 20 PB : 20000, 15000, 72000, 80000 : $\sum PB = 1,87,000$ $\sum P = 15,000$, STDR formula STDR(A) = 14, STDR(B) = 12.47 Comment: Town B is more healthier.	1 1 1 1 1 1+1 1+1+1
38	p_1q_0: 90, 80, 50, 150 : $\sum p_1q_0 = 370$ p_0q_0: 60, 60, 60, 150 : $\sum p_0q_0 = 330$ p_1q_1: 60, 100, 100, 125 : $\sum p_1q_1 = 385$ p_0q_1: 40, 75, 120, 125 : $\sum p_0q_1 = 360$ $P_{01}^{ME} = \frac{1}{2}\left(\frac{\sum p_1q_0}{\sum p_0q_0} + \frac{\sum p_1q_1}{\sum p_0q_1}\right) \times 100 = \frac{1}{2}\left(\frac{370}{330} + \frac{385}{360}\right) \times 100 = 109.53$, $P_{01}^{F} = \left(\sqrt{\frac{\sum p_1q_0}{\sum p_0q_0} \times \frac{\sum p_1q_1}{\sum p_0q_1}}\right) \times 100 = \left(\sqrt{\frac{370}{330} \times \frac{385}{360}}\right) \times 100 = 109.5$	1 1 1 1 3 3
39	$\sum y = 630, \sum x = 0, \sum x^2 = 28, \sum xy = 56, n = 5$ $a = \frac{\sum y}{n} = 90$ and $b = \frac{\sum xy}{\sum x^2} = 2$ ∴ The trend line is, Y = 90 + 2 X, Trend values: 82, 84, 86, 90, 92, 94, 96 $\hat{Y}_{2008}$ = 98 thousand tones.	Table-4 1+1 1+2 1
40	$N = 256, n = 5, np = \frac{\sum fx}{N} = \frac{640}{256} = 2.5, p = \frac{np}{n} = \frac{2.5}{5} = 0.5 \Rightarrow q = 0.5$ $P(x) = nC_x(p)^x(q)^{n-x}$, $T(0) = N \times P(0) = 256 \times q^n = 256 \times (0.5)^5 = 8$ Remaining freqs are calculated by: $T(x) = \frac{n+1-x}{x}\frac{p}{q}T(x+1)$; Freqs: 8, 40, 80, 80, 40, 8 H_0: B.D is a good fit and H_1: B.D is not a good fit. Test Statistic, $\chi^2 = \sum\frac{(O_i-E_i)^2}{E_i} = 149.1375$ d.f = 4, $k_2 = 13.3$ Here, $\chi^2 > k_2$ ∴ Reject H_0 i.e., B.D is not a good fit.	1 1+1 2 1 1+1 1+1

SECTION - E

VIII.41	$\mu = 64, \sigma = 2$, $Z\left(= \frac{x-\mu}{\sigma} = \frac{x-64}{2}\right)$ is a SNV $P\left(\frac{x-\mu}{\sigma} \geq \frac{60-64}{2}\right) = P(Z \geq -2) = 0.9772$ $P\left(\frac{x-\mu}{\sigma} < \frac{66-64}{2}\right) = P(Z < 1) = 1 - 0.1587 = 0.8413$	1 1+1 1+1
42	H_0: The difference between population proportions is not significant & H_1: $P_1 \neq P_2$ $P = \frac{n_1p_1+n_2p_2}{n_1+n_2} = 0.3, Q = 0.7$ Test Statistic, $Z_{cal} = \frac{p_1-p_2}{\sqrt{PQ\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \frac{-0.06}{0.0561} = -1.069$ k = -1.96, Here - k < Z_{cal} < k ∴ Accept H_0 i.e., The difference between population proportions is not significant.	1 1 1+1 1
43	H_0: The vaccine is not effective in controlling the tuberculosis. H_1: The vaccine is effective in controlling the tuberculosis. $\chi^2_{cal} = \frac{N(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)} = \frac{60(12\times 6 - 26 \times 16)^2}{38 \times 22 \times 28 \times 32} = 9.48$ k_2= 6.65 $\chi^2_{cal} > k_2$ ∴ reject H_0, The vaccine is effective in controlling the tuberculosis.	1 1+1+1 1
44	$P - S_n$: 2000, 2500, 3000, 3500, 4000 $\sum C_i$: 100, 300, 630, 1140, 2000 T_n : 2100, 2800, 3630, 4640, 6000 A(n) : 2100, 1400, 1210, **1160**, 1200 Minimum annual average cost is Rs.1160. ∴ Optimal replacement period is 4th year.	1 1 1 1 1