II PUC ANNUAL EXAMINATION – MARCH 2025
Answer Key – Statistics

Section A

I. Choose correct answers   1x5=5

1. d. Fecundity

2. b. 100

3. a. Mean=Variance

4. b. Accepting H_0 when it is not true

5. c. $\Sigma a_i = \Sigma b_i$

II. Fill in the blanks   1x5=5

6. Retail

7. Asymptotic

8. Size

9. Defect

10. Degenerate

III. 11. Match the following   1x5=5

a. Total fertility rate   iii) Σ Annual ASFR

b. $P_{01} x Q_{01} = V_{01}$ vi) Factor Reversal Test

c. Range of Bernoulli distribution   v) x=0, 1

d. $H_1: P_1 < P_2$ i) $H_0: P_1 = P_2$

e. Shortages are allowed   iv) Inventory model – II

IV. Answer the following questions   1x5=5

12. Size of the cohort

13. Natural calamities – flood, earthquake

14. Mean = 0

15. A statistical constant of the population is called parameter

16. Maximum of row minimums

V. Answer any FIVE questions 2x5=10

17.

Year	Sales	Trend values
2014	110	
2015	105	110
2016	115	
2017	110	
2018	120	120
2019	130	

18.
1. There are no sudden jumps in the values of dependent variable from one period to another.
2. There will be no consecutive missing values in the series

19. $SD = \sqrt{pq} = \sqrt{0.2 \times 0.8} = 0.4$

20. Median = 9.34
Mode = n-2=8

21. i. Point estimation
ii. Interval estimation

22. Test Statistic: $t_{cal} = \dfrac{\bar{d}}{s_d/\sqrt{n-1}} \sim t_{n-1}$

Degrees of freedom = n-1

23. UCL = $\lambda' - 3\sqrt{\lambda'} = 10$

24. $Q^0 = \sqrt{\dfrac{2RC_3}{C_1}} = 500$ units

Section C

Answer any FOUR questions 5x4=20

25.

Group	Price		Weight	P=$\frac{p_1}{p_0} \times 100$	WP
	Base year	Current year			
Food	4000	4600	20	115	2300
Clothing	1400	1680	10	120	1200
Fuel	1500	1890	10	126	1260
Housing	2000	3000	20	150	3000
Others	3000	3600	20	120	2400
			80		10160

CLI = $\dfrac{\sum WP}{\sum W} = \dfrac{10160}{80}$ 127

26. $(y - 1)^5 = 0$

       $y_5 - 5y_4 + 10y_3 - 10y_2 + 5y_1 - 1y_0 = 0$

       $y_2 = 17$

       $y_6 - 5y_5 + 10y_4 - 10y_3 + 5y_2 - 1y_1 = 0$

       $y_6 = 89$

27. X: Number of vegetarians

       p=0.4, n=4

       $p(x) = {}^nC_x p^x q^{n-x}$, x=0, 1, 2, … , n

       P(2 are vegetarians) = p(2) = 0.3456

       P(at least 1 vegetarian) = 1 – p(0) =0.8704

28. Mean $= \frac{na}{(a+b)} = 3$,   Variance $= \frac{nab(a+b-n)}{(a+b)^2(a+b-1)} = 0.6666$

29. H_0: $\mu = 55$

   H_1: $\mu \neq 55$

   Under H_0, Test statistic is given by,

   $Z_{cal} = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} \sim N(0, 1)$

        $= 2$

   At 5% level of significance, the critical value (k) is ± 1.96

   We reject H_0 if $Z_{cal} > k$. Otherwise we accept H_0. On comparison; we reject H_0 and accept H_1. Hence mean weight of large group of students is not 55kg.

30.   Saddle point exist at (1, 2)

        Strategy of player A = A_1

        Strategy of player B = B_2

        Value of the game 0

        Game is fair.

31.

Year (n)	C_i	S_n	$P-S_n$	ΣC_i	$A(n)=\frac{P-S_n+\Sigma C_i}{n}$
1	1000	20000	10000	1000	11000
2	2000	16000	14000	3000	8500
3	3100	13000	17000	6100	7700
4	4500	10000	20000	10600	7650
5	6000	8000	22000	16600	7720

Machine should be replaced at the end of 4th year.

Answer any TWO questions   **5x2=10**

32. X: Daily wages of workers

    Given $\mu=600$ and $\sigma = 50$ and $X \sim N(\mu, \sigma^2)$. $Z = \frac{X-\mu}{\sigma} = \frac{X-600}{50} \sim N(0, 1)$

    $P[550 < X < 650] = P[-1<Z<1] = 0.6826$

    Number of workers = 273.04 = 273

33. H_0: accidents occur uniformly

   H_1: accidents do not occur uniformly.

Under H_0, the theoretical frequencies (E_i) are $70/7=10$

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat	**Total**
Oi	5	9	12	10	6	13	15	**70**
Ei	10	10	10	10	10	10	10	**70**
$\dfrac{(O_i - E_i)^2}{E_i}$	2.5	0.1	0.4	0	1.6	0.9	2.4	**8**

Under H_0, Test statistic is given by, $\chi^2{}_{cal} = \sum \frac{(O_i - E_i)^2}{E_i} \sim \chi^2_{n-c} = 8$

Here n =7,

Hence at 1% level of significance critical value for (7-1)=6 degrees of freedom is $k_2 =$ 16.8. We reject H_0 if $\chi^2{}_{cal} > k_2$ otherwise we accept H_0.

On comparison we accept H_0. Hence accidents occur uniformly throughout the week.
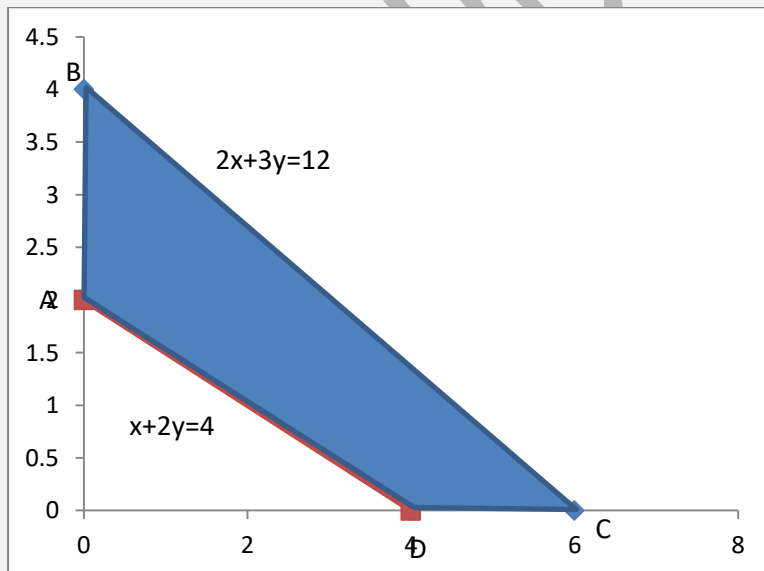
34. $\bar{R} = \frac{\sum R}{k} = \frac{30}{6} = 5$

   The control limits for R chart are,

   $CL = \bar{R} = 5$

   $LCL = D_3 \bar{R} = 0\,(5) = 0$

   $UCL = D_4 \bar{R} = 2.282\,(5) = 11.41$

35. x+2y=4; x=0, y=2 and y=0, x=4

   2x+3y=12; x=0, y=4 and y=0, x=6

Corner points	Z=4x + 5y
A(0, 2)	10
B(0, 4)	20
C(6, 0)	24 - Maximum
D(4, 0)	16

Given LPP has unique solution. x=6, y=0 and Z=24

Section D

Answer any TWO questions   10x2=20

36. a.

Year	Female population	Female births	WSFR
15-19	14000	252	18
20-24	12000	780	65
25-29	11000	770	70
30-34	8000	336	42
35-39	7000	168	24
40-44	5000	70	14
45-49	4000	12	3
			236

GRR = i × Σ WSFR,   WSFR = $({}^fB_x/{}^fP_x) \times 1000$

$\quad$ =236x5 = 1180

b.

Age group	Population	Deaths	Std. population	A	PA
0-21	11000	143	10000	13	130000
21-40	16000	80	15000	5	75000
40-60	12000	156	15000	13	195000
60 and above	8000	240	10000	30	300000
			50000		700000

ASDR= $\frac{D_t}{P_t} \times 1000$

STDR $_A$= $\frac{\sum PA}{\sum P} = \frac{700000}{50000} = 14$

37.

Item	p_0	q_0	p_1	q_1	p_0q_0	p_1q_1	p_0q_1	p_1q_0
A	16	24	21	30	384	630	480	504
B	18	28	24	35	504	840	630	672
C	12	27	10	45	324	450	540	270
D	15	21	20	30	315	600	450	420
					1527	2520	2100	1866

$P_{01}^L = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$ = 122.2003

$P_{01}^P = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$ = 120

$P_{01}^F = \sqrt{P_{01}^L \times P_{01}^P}$ = 121.0951

5

38.

year	Profit (in crore Rs.)	x	x^2	x^3	x^4	xy	x^2y
2019	32	-2	4	-8	16	-64	128
2020	20	-1	1	-1	1	-20	20
2021	30	0	0	0	0	0	0
2022	22	1	1	1	1	22	22
2023	26	2	4	8	16	52	104
	130		**10**	**0**	**34**	**-10**	**274**

$y = a + bx + cx^2$, where a, b and c are constants, found using the normal equations,

$n a + b \Sigma x + c\Sigma x^2 = \Sigma y$

$a\Sigma x + b \Sigma x^2 + c\Sigma x^3 = \Sigma xy$

$a\Sigma x^2 + b\Sigma x^3 + c\Sigma x^4 = \Sigma x^2 y$

On solving, a=24, b=-1, c=1

$y = 24 - x + x^2$

For 2024, x=3 and y=30