Reg. No…….. Name……

B. Sc. DEGREE END SEMESTER EXAMINATION: OCTOBER 2022

SEMESTER **5: COMPUTER APPLICATION**

COURSE: **19U5CRCST6: STATISTICAL QUALITY CONTROL AND OPERATIONS RESEARCH**

(*For Regular - 2020 Admission and Supplementary - 2019 Admission)*

Time: Three Hours Max. Marks: 75

(Use of Scientific calculator and statistical tables are permitted)

PART A

(Each Question carries **1** mark. Maximum marks from this part is **10**)

1. Mention any two objectives of SQC.
2. Define attributes?
3. Distinguish between probability limit and tolerance limit.
4. What do you mean by a product control?
5. Name the control charts for variables.
6. Write the control limits for R chart.
7. Write the matrix form of a LPP.
8. What is meant by surplus variables?
9. Define degeneracy in a Transportation problem.
10. Define feasible solution of a transportation problem.
11. Give an example of an assignment problem.
12. Define two person zero sum game.

PART B

(Each question carries **3** marks. Maximum marks from this part is **15**)

13. Describe OC curve for control charts.
14. Distinguish between control chart for variable and control chart for attributes.
15. A machine is set to deliver packets of a given weight. Ten samples of size five each were recorded. Below are given relevant data:

Sample number	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	15	17	15	18	17	14	18	15	17	16
R	7	7	4	9	8	7	12	4	11	5

Calculate the control limits for mean chart and the range chart .

16. Solve the problem graphically:

    Maximise $Z = 2x_1 + 3x_2$

    Subject to

    $$x_1 + x_2 \leq 30,\ x_2 \geq 3,\ 0 \leq x_2 \leq 12,\ x_1 - x_2 \leq 0,\ 0 \leq x_1 \leq 20,\ x_1 \geq 0,\ x_2 \geq 0.$$

17. Solve the game whose pay off matrix is given by

	M	N
P	1	-2
Q	2	-1

18. Derive a mathematical model of a Transportation Problem.
19. Distinguish between pure strategy and mixed strategy.

PART C

(Each question carries **5** marks. Maximum marks from this part is **20**)

20. Explain warning limits. Justify the 3σ limits as control limits in any control chart.
21. What is the role of C charts in SQC?
22. What is mean by process control in industrial statistics?
23. Explain graphical method of solving LPP.
24. Use duality to solve the following LPP

    Maximise $Z = 8.5x_1 + 4x_2$

    Subject to

    $2x_1 + x_2 \geq 8,\ x_1 + 3x_2 \geq 9,\ 6x_1 + x_2 \geq 12,\ x_1 \geq 0,\ x_2 \geq 0.$

25. Solve the following Assignment Problem so as to minimize the total distance travelled,

    To

From

	A	B	C	D	E	F
a	31	62	29	42	15	41
b	12	19	39	55	71	40
c	17	29	50	41	22	22
d	35	40	38	42	27	33
e	19	30	29	16	20	23
f	72	30	30	50	41	20

PART D

(Each question carries **10** marks. Maximum marks from this part is **30**)

26. (a) Explain the construction and interpretation of mean chart and range chart.

    (b) Derive the OC function and ARL of $\bar{X}$ chart.

27. In a manufacturing industry the plate thickness is one of the important CTQ factor, during Measure phase, project team performed the process capability study and identified that the process is not capable (less than 2 sigma). In Analyze phase, collected 20 sets of plate thickness samples with a subgroup size of 4

Sample	Measured value			
	1	2	3	4
1	44	26	24	34
2	50	48	51	43
3	32	28	26	22
4	52	55	56	44
5	16	16	21	26
6	36	36	35	31
7	21	22	18	21
8	29	21	23	22
9	26	46	44	14
10	24	22	22	44
11	18	24	24	49
12	24	20	26	23
13	19	21	27	28
14	8	11	12	12
15	24	18	27	24
16	56	52	56	50
17	32	22	18	25
18	8	12	11	17
19	51	54	52	49
20	30	28	35	22

Draw sample, range charts and comment on the state of control of the process.

28. Solve the following LPP

Maximise $Z = 3x_1 + 5x_2 + 4x_3$

Subject to

$2x_1 + 3x_2 \le 8,\ 2x_2 + 5x_3 \le 10,\ 3x_1 + 2x_2 + 4x_3 \le 15,\ x_1 \ge 0,\ x_2 \ge 0, x_3 \ge 0$.

29. Solve the game whose payoff matrix is given below:

		Player B			
		B1	B2	B3	B4
	A1	3	2	4	0
Player A	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8