There are 5 questions. You must answer 4 questions.

1. a) What do you mean by the Six Sigma Distribution? Explain with a necessary diagram.

b) A company produces Boards, and their monthly sales have been recorded over the past five months. Using **Exponential Modelling,** the company aims to forecast the demand for the next month. ($\alpha = 0.3$). The 3rd month forecasted value was 195; now, calculate the forecasted values for years **1 and 6**.

Month	1	2	3	4	5
Actual Demand	190	170	215	205	190

2. a) Apply the **Critical Ratio** sequencing rules to these five jobs to find: Average completion time, Utilization, Average numbers of jobs in the system, Average job lateness.

Job	Job Work (Processing) Time (Days)	Job Due Date (Days)
A	5	7
B	10	6
C	6	10
D	4	8
E	9	5

b) Use the **Johnson Rule** to draw the Gantt Chart for the following sequencing problems,

Job	Work Center 1 (Drill Press)	Work Center 2 (Lathe)
A	4	13
B	6	5
C	5	7
D	7	3
E	9	10

3. a) A factory manufactures two types of gadgets, called Gadget A and Gadget B. To meet market demand, the factory must produce at least 150 units of Gadget A and at least 100 units of Gadget B every day. However, due to limitations in production capacity, the factory cannot produce more than 300 units of Gadget A or 250 units of Gadget B on any given day. Additionally, to satisfy contractual obligations, the total number of gadgets produced daily, combining both Gadget A and Gadget B, must be at least 350 units. Each unit of Gadget A sold earns the factory a profit of $4, while each unit of Gadget B yields a higher profit of $6. The factory's management wants to determine the daily production quantities of Gadget A and Gadget B that will maximize the total

profit, while satisfying all the production and demand constraints. Solve the problem using graphical techniques. (No graph paper will be provided)

b) In a competitive game between Player 1 and Player 2, each player has three possible strategies to choose from. The goal for both players is to maximize their respective payoffs, and since this is a zero-sum game, any gain for Player 1 is a loss for Player 2, and vice versa. The outcome of the game is determined by the combination of strategies chosen by both players. The payoff to Player 1 for each pair of chosen strategies is determined by the following rules: If Player 1 chooses Strategy 1 and Player 2 chooses Strategy 1, Player 1 gains a payoff of 3. If Player 1 chooses Strategy 1 and Player 2 chooses Strategy 2, Player 1 loses 1. If Player 1 chooses Strategy 1 and Player 2 chooses Strategy 3, Player 1 gains 3. Similarly, the payoffs for the other combinations of strategies are as follows: When Player 1 selects Strategy 2, If Player 2 selects Strategy 1, Player 1 loses 3. If Player 2 selects Strategy 2, Player 1 gains 1. If Player 2 selects Strategy 3, Player 1 gains 7. When Player 1 selects Strategy 3: If Player 2 selects Strategy 1, Player 1 gains 7. If Player 2 selects Strategy 2, Player 1 gains 3. If Player 2 selects Strategy 3, Player 1 gains 5.

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4. a) Calculate the minimum cost of transporting goods using the **Northwest Corner Rule**.

	Facility 1	Facility 2	Facility 3	Facility 4	Supply
Warehouse 1	4	8	8	6	300
Warehouse 2	6	4	3	7	410
Warehouse 3	5	9	7	5	500
Warehouse	8	7	6	4	390
Demand	450	380	420	350	1600

b) A mid-size electronics retailer tracks monthly smart speaker sales and believes demand follows **a linear trend,** now find the forecasted value for the year 7 and draw the trend line.

Month	1	2	3	4	5
Unit sold	240	255	260	270	290

5. a) A Subassembly of a computer system consists of A, B, and C Components. The system contains 3 components of A (in parallel), 4 components of B (in parallel), and 2 components of C in series. Reliability per 120 hours of A = 0.80, B = 0.99, C = 0.75. Find the MTBF of the system and the system failure rate. Find out the probability that the system will not work for 200 hours.

b)   **i)** In a precision gear manufacturing plant, the cost of rework for a defective gear is $3.The process specification is: 12.00 ± 0.08 mm. It was found that the production process mean was 11.974 mm and the standard deviation was 0.02 mm.

ii) Company Y receives an average of 8 complaints per month. In June, they received 13 complaints. Management sets an acceptable complaint level at 1 per month. The company incurs a direct cost of $200 per complaint to correct the problem.

$$b = \frac{\sum_{i=1}^{n} x_i y_i - n\bar{x}\,\bar{y}}{\sum_{i=1}^{n} x_i^2 - n(\bar{x})^2} \qquad a = \bar{y} - b\bar{x}$$