



United International University (UIU)

Term Final Examination

IPE 4101: Industrial & Production Engineering

Fall Trimester: 2024

Total time: 2:00 hours

Date: 05/02/2025

Total marks: 40

Section: A/B/C/D/E/F/G

There are 5 questions. You must answer 4 questions.

1. a) State two ways to determine that a process is out of control and support your explanation with appropriate figures. [3]

b) A company produces Wooden Boards, and their monthly sales have been recorded over the past five months. Using the Exponential Smoothing Method, the company wants to find the forecasted demand for the next two months based on the trend from the last five months. Now, find the forecasted demand for months 1, 2, 4, 5 & 6, and the forecasted demand for the 3rd [7]

Month	1	2	3	4	5
Actual Demand	180	190	185	145	130

month, 180, $\alpha = .2$.

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. [7]

Job	Job Work (Processing) Time (Days)	Job Due Date (Days)
A	4	12
B	5	8
C	7	13
D	3	7
E	8	9

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	3 -
B	6	5 -
C	9	7 -
D	8 -	10
E	5 -	6

[3]

3. a) A factory produces two products, Type A and Type B, and seeks to minimize total production costs, where each unit of Type A costs \$3 and Type B costs \$2 to produce. The production must use at least 4 labor hours, with Type A requiring 1 hour per unit and Type B requiring 2 hours. Machine capacity is limited to 6 hours, with Type A using 3 hours per unit and Type B using 1 hour. Additionally, due to storage constraints, the total number of products produced cannot exceed 5 units. The goal is to find the optimal production quantities of Type A and Type B to minimize costs while meeting these constraints. Find the cost and the numbers of the products needed to be sold. [6]

b) A pharmaceutical company produces tablets with an average weight of 250 mg and a standard deviation of 2 mg. Based on Six Sigma quality standards, determine: i) The upper and lower specification limits for the tablet weight. ii) If the weight exceeds the upper limit by 3 mg, calculate the cost of exceeding using the Taguchi Loss Function, where K is 550 [4]

4. a) A circuit has 5 components (A, B, C, D, E) arranged as follows: A and B are in series, connected in parallel with C. This combination is then connected in series with a parallel arrangement of D and E. The reliability of A is 0.90, the failure probability of B is 0.05, the reliability of C is 0.80, the failure probability of D is 0.10, and the reliability of E is 0.85. Calculate the overall reliability of the circuit. [4]

b) A Subassembly of a computer system consists of A, B, and C Components. The system contains 3 components of A (in parallel), 2 of C (in parallel), and one B in series. Reliabilities per 130 hours of A = 0.85, B = 0.98, C = 0.78. Find the MTBF of the system and the system failure rate. Find out the probability that the system will not work for 250 hours. [6]

5. a) Two players, **Player 1** and **Player 2**, are engaged in a game where they must each choose one of three colors: **Red**, **Green**, or **Blue**. If Player 1 chooses **Red** and Player 2 chooses **Green**, Player 1 earns **4 dollars**. If Player 1 chooses **Red** and Player 2 chooses **Blue**, Player 1 earns **3 dollars**. If Player 1 chooses **Green** and Player 2 chooses **Red**, Player 1 loses **2 dollars**. If Player 1 chooses **Green** and Player 2 chooses **Blue**, Player 2 earns **3 dollars**. If Player 1 chooses **Blue** and Player 2 chooses **Red**, Player 2 loses **5 dollars**. If Player 1 chooses **Blue** and Player 2 chooses **Green**, Player 1 earns **3 dollars**. If both players choose the same color, none loses. Develop the payoff matrix and optimal strategy for both players using **Game Theory**. [5]

b) A car manufacturing company wants to forecast the production of vehicles based on historical data. The production data (in thousands) for the past years is as follows: [5]

Year	2020	2021	2022	2023	2024
Actual Production	200	207	230	228	236

Using linear regression model predicts the production amount in 2025.

CO2- Analyze various industrial problems by using operation management, technique, operation research technique and cost accounting technique and solve it. Applicable for questions 1(b) & 2. CO3- Explain the importance of quality control, and various industrial engineering techniques to improve the process in any engineering sector and how this affect the organization and customers. Applicable for questions 1(a), 4 & 5 (a). CO4- Analyze the optimization problems and solve it by using graphical method. Applicable for questions 3 & 5 (b).

$$Y = a + bx$$

$$a = Y - bx$$