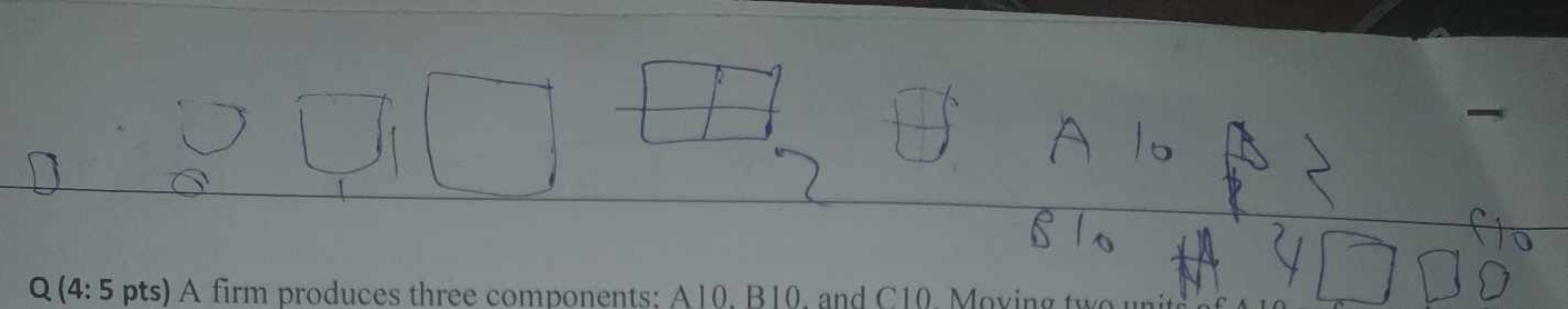

Q (4: 5 pts) A firm produces three components; A10, B10, and C10. Moving two units of A10 or four units of C10 is equivalent to moving on B10. The departments are arranged in a linear flow pattern in the order A-B-C. Prepare a from-to-chart.

Component	Daily production	Equivalent daily flows compared to B10	Routing	Total flow compared to B10
A10	40	80	ABC	160
B10	30	120	BAC	240
C10	20	20	CAC	40

FROM/TO	A	B	C		
A	—	80	120		
B	120	—	80		
C	20	0	—		

Q (5: 4 pts) A firm produces three components; A10, B10, and C10. Moving two units of A10 or four units of C10 is equivalent to moving on B10. The departments are arranged in a linear flow pattern in the order A-B-C. Given the distance between the departments (Pickup/Delivery at midpoints) = 40 ft.

Component	Daily production	Equivalent daily flows	Routing	Total flow compared to C10	Total traveled distance/route
A10	40	80	ABC	160	80 ft
B10	30	120	BAC	240	120 ft
C10	20	20	BCAC	600	240 ft

Q (6: 5 pts) Three criteria A to C are used to evaluate the alternative designs 1, 2, and 3 based on the most important criterion (largest percentage). **Identify the important criterion and determine the best design.**

Criteria	A	B	C	Row total	Row %
A	1	5	1/5	6.2	26.3
B	1/5	1	10	11.2	47.6
C	5	1/10	1	6.1	25.9

Design alternative	1	2	3	Row total	Row %
1	1	1/5	5	6.2	26.3
2	5	1	1/10	6.1	25.9
3	1/5	10	1	11.2	47.6

Design evaluation	A	B	C
1		0.1234	
2		0.1237	
3		0.225	

total 0.4728

19.5 + 7.5 + 1 = 28/30

The University of Jordan
Department of Industrial Engineering
Facilities Planning Midterm Exam 2023
Prof. Al-Refaie Abbas

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Q1 (8 points) Please fill in the missing terms or phrases in the blank.

1. Flows can be measured Qualitatively using the closeness relationship values.
2. The Activity network diagram is used to develop a work schedule for the facilities design effort.
3. Reducing the flow density through containerization results in minimizing total cost.
4. The flow within process department typically occurs between workstations and aisles.
5. In the pull production system, the production card is used to authorize the production of more components or assemblies.
6. The subjects of the material management system are the materials, parts, and supplies purchased by a firm and required for the production of its product.
7. An important consideration in the flow between departments is the location of the pickup and delivery stations.
8. If the largest load is between 6 and 12 ft^2, the aisle allowance percentage is 10-20
9. Workstation should be designed to maximize operator safety, comfort, and productivity.
10. The resources of the material flow system include the manufacturing, assembly, and storage department.
11. If the product is large and awkward to move, the type of the planning department should be fixed location planning department
12. When both variety and volume are low, the preferred layout should be fixed location layout
13. The principle of minimize the flow includes the elimination of the traveled distance.
14. Increased work in process is one limitation of the process layout.
15. For product planning department, all the workstations required to produce the product department should be combined.
16. If the flow of products from a manufacturing facility is to be the subject of the flow, then the flow process is referred to as physical distribution system
17. Two departments cannot be placed adjacent to each other with a relationship value of X (undesirable)
18. A planning department consists of three machines;4 ft ×12 ft. The total area required considering the 10 % aisle allowance = 153.4 ft

-1

Q2 (4 pts) During one 10-hour shift, **1000 non-defective parts are desired from fabrication operation**. The standard time is 20 minutes. Because the machine operator is unskilled, the actual time is 30 minutes. **On average, 10% of the fabricated parts are reworked** via a rework operation with a repair rate of 85%. Assuming that each of the machines used for this operation will not be available for one hour of each shift, **determine**:

- Input quantity =

$$\frac{1000}{0.9 + 0.1 \times 0.85} = 1016 \text{ parts}$$

- The number of machines required=

$$f = \frac{20 \times 1016}{0.66 \times 9 \times 60} = 5 \text{ machines}$$

Q3 (4 pts) Cases of the product are conveyed to a palletizer, which has to be programmed by an operator. Typically, 25 pallet loads are completed before the palletizer has to be reprogrammed; **reprogramming** requires 6 minutes. The palletizer operates **automatically** for 40 minutes. The operator must restock the machine with empty pallets; this can be done at any time **during the last 10 minutes** of the palletizer's run time; **restocking pallets requires 5 minutes**. **Travel time** between palletizers, plus data entry in the computer by the operator, requires 3 minutes.

- What is the ideal number of palletizers = 3.285

$$n' = \frac{(a+b)}{(a+b)} = \frac{46}{14}$$

4

- The cost per unit produced without creating idle time for the operator = ----------

$$\frac{(10 + 4 \times 30)(6+8)}{60} = 30.3\$$$

- The repeating cycle without creating idle time for the palletizers = 46 min **(1 pt)**

$$n = 3 \qquad (a+b) = 46$$