

NATIONAL EXAMS – MAY 2003

98-IND-A3 – FACILITIES PLANNING

3 HOURS DURATION

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. Any non-communicating calculator is permitted. You must indicate the type of calculator being used, i.e. the make and model designation of the calculator, on the first inside left hand sheet of the exam work book.
3. This is an Open Book Examination.
4. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
5. All questions are of equal value.
6. Show all calculations.

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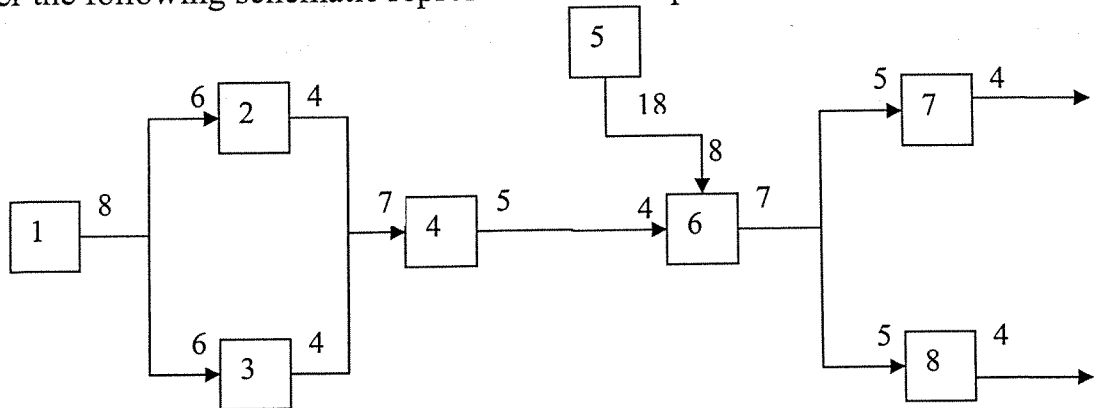
Question 1 – 20 Marks

The island of Margarita is famous for its delicious lobsters. They are caught at sea and brought to three main harbours around the island. A refrigerated warehouse is needed to which the lobsters will be shipped by airplane from the harbours, as shown in the accompanying table. Since the product's freshness is so important, where should the warehouse be located to minimize the cost of losing market due to lack of freshness?

Harbour	Coordinates	Trips/Day
1	4, 2	5
2	4, 7	7
3	10, 5	11

Question 2 – 20 Marks

Consider the following schematic representation of a production line:



The number at the entry of each station is the number of units of input that requires one worker to produce the number of units of output shown at the exit of each station. For example, at station 6, each worker is required to produce 7 units of output, using 8 units from station 5 and 4 units from station 4. Develop the labour requirements to produce 12 units each from stations 7 and 8. Assume the following initial inventory of semi-finished product is available after each station to begin production of the 24 units.

Station	1	2&3	4	5	6
Inventory	5	8	4	3	6

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Question 3 – 20 Marks

A robot is used for material handling in a system of three machine stations: B, C and D. Stations A and E are input (i.e. load only) and output (i.e. unload only) stations respectively. The loading and unloading times are 0.2 minutes each. Movement between successive stations takes 0.3 minutes. Processing times on machine stations B, C and D are 2, 3 and 4 minutes, respectively. The robot completes the cycle of one part before returning to the input station to start processing the next part. Determine the cycle time and production rate for the system.

Question 4 – 20 Marks

Consider the layout of five equal-sized departments. The material flow matrix is given in the figure below.

- a. Develop the final adjacency graph using the graph-based procedure.
- b. Develop a block layout based on the final adjacency graph in part a.

From/To	A	B	C	D	E
A	-	0	5	25	15
B	0	-	20	30	25
C	0	25	-	40	30
D	30	5	20	-	0
E	20	30	5	10	-

Question 5 – 20 Marks

The docks of Acme Plumbing Manufacturing receive trucks for loading and unloading. Suppose that the arrival pattern of the trucks follows a Poisson distribution with a mean of two trucks per hour, and the service time at each dock follows an exponential distribution with a mean of two trucks per hour. Find the number of docks needed so that on average an arriving truck does not spend more than $\frac{1}{2}$ hour in the plant.

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Question 6 – 20 Marks

- a. What differences in packaging would be apparent between a household cleaner sold for home use and the same cleaner packaged for industrial use?
- b. What are the goals in packaging?
- c. Describe how each of the following materials is used in packaging:
 - i. Glass
 - ii. Paper carton
 - iii. Wood
 - iv. Styrofoam chips
 - v. Air cushion mats
 - vi. Formed Styrofoam
- d. Briefly describe the circumstances that would lead you to consider each of the following conveyors in preference to the others:
 - i. Belt conveyor, roller supported
 - ii. Belt conveyor, slider bed supported
 - iii. Powered roller conveyor
 - iv. Towline conveyor.