Mansoura University
Faculty of Engineering
Department of Production Engineering and Mechanical Design

Factories Planning and Production Processes

Final May 2012, 3rd Year at Production Engineering and Mechanical Design Department.
Please solve the next questions. Use graphics as possible. Unlimited open source request. (Time: 3 hrs.)

1-Table 1 shows number of units of a product, produced each working day over past four weeks (in 100's of units), by a workshop. Forecast that for each working day of week 5.

Table 1

	Week 1	Week 2	Week 3	Week 4
Monday	16.2	17.3	18.6	19.1
Tuesday	12.2	13.5	14.1	15.8
Wednesday	14.2	15.0	16.0	17.9
Thursday	17.3	18.6	19.9	20.6
Friday	22.5	23.9	24.9	25.3

2-Table 2 shows the assembly information of an appliance: tasks; task time in minutes; and immediate predecessors (IP) of each task.

Table 2

Task i	1	2	3	4	5	6	7	8	9	10	11	12
IP Tasks	–	1	2	2	2	2	3, 4	7	5	6, 9	8, 10	11
Time t_i	12	6	6	2	2	12	7	5	1	4	6	7

a) Draw the precedence diagram of this assembly.
b) Use the *Ranked Positional Weight Technique* to design an assembly line, with minimum number of work stations, to produce 4 units per hour.
c) Estimate the performance of the designed line.
d) Construct a flowchart for the *Ranked Positional Weight Technique*.

3-A pump has a triangularly distributed TTF within the time interval [0, 5,000] operating hrs. This pump costs \$2,000 for purchase, \$200 for installation and \$800 due to the consequences of each failure.

a) Compute the reliability of this pump based on MTTF.
b) What are the values of availability and maintainability?
c) Is it correct to adopt the typical bathtub as a failure pattern for this pump?
d) Which is economic for maintenance, *constant interval replacement* or *age based replacement*?

4-A machine shop needs 2,000 units/year of a specific spare part. The shop can produce its needs at 5,000 units/year. Each unit costs \$40 for production and \$5/year for carrying. The setup cost amounts to \$200. The maintenance strategy allows receiving potential shortages from an outer supplier once at end of the cycle, which costs \$50/unit for price and \$10/unit/year for shortage. (Let Q = production run size, D = annual demand rate, M = annual production rate, S = shortage size per cycle, p = unit production cost, w = unit price from outer supplier, h = holding cost/unit/year, c = shortage cost/unit/year, and A = setup cost.)

a) Construct a model for this inventory system based on *production run size* and *shortage size*.
b) Find the optimal total cost of this system based on the proposed model.

My best wishes...Prof. Dr. Hassan Soltan