National Technical Examinations May 2010
98-Ind-A4, Production Management

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. This is a Closed Book exam. Candidates may use one of two calculators, the Casio or Sharp approved models.

3. Answer any five questions. Five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.

4. All questions are equally weighted.

5. Write your answers in point-form whenever possible.

Marking Scheme

	a.	b.	c.	d.	e.
1.	4	4	4	4	4
2.	7	7	6		
3.	10	10			
4.	20				
5.	8	6	6		
6.	8	6	6		
7.	10	4	6		

Front Page

National Technical Examinations May 2010
98-Ind-A4, Production Management

1. **Briefly** define and discuss the significance of the following ideas.
   a. Mass customization;
   b. Mass production;
   c. Six Sigma;
   d. Interchangeable parts;
   e. Division of labour.

2. The MagRite factory stocks rollers that are used in the production of toys. The parts are needed throughout the 52-week year. Rollers are used at a constant rate. The Manager collected the following data.

Item	Roller
Annual demand	1 000
Holding cost (annual cost/item)	$2
Ordering cost	$10

   a. Develop an inventory control system for the rollers.
   b. If a $100 discount is given for orders in quantities of 500 or more, what will be your ordering policy?
   c. For this item, describe a more sophisticated inventory policy, and specify the data that must be collected to determine the parameters of the policy.

3. The following table shows the actual sales of iPods for the first six months of last year at a small electronics retailer.

Month	Sales
January	100
February	241
March	301
April	295
May	240
June	284

   a. Calculate a sales forecast for the remaining six months of the year. Use an analytical method to measure the accuracy of your forecast.
   b. Comment on the accuracy of the forecast, and suggest ways in which the forecast can be improved.

4. A manufacturer produces a variety of office chairs. The manager is preparing an aggregate production plan for the next six months, and has the following information.

Month	1	2	3	4	5	6
Forecast Demand	150	150	160	180	110	140

Costs (per unit)

Regular time	$100
Overtime	$150
Subcontract	$200
Inventory (per month)	$25
Back-order (per month)	$100
Hiring cost (per worker)	$1500
Firing cost (per worker)	$2500

There are 7 workers, each making 35 chairs per month. The maximum production of chairs during overtime is 15 per month. Subcontracting can handle a maximum of 12 chairs per month. Assume that the beginning and ending inventories are zero, and backorders are not allowed at month 6.

Write the mathematical formulation that can be solved to produce the minimum-cost aggregate plan for this case. *Note that only the model is required, not the solution.*

5. In certain situations, CONWIP and Kanban control systems can have identical results.
    a. Give an example where CONWIP and Kanban will produce identical behavior in a manufacturing system.
    b. Describe the ideal environment for implementing a Kanban system.
    c. Describe the ideal environment for implementing a CONWIP system.

6. The following table shows the data for a small construction project. Timely completion is very important.

Activity	Precedes	Duration (days)
A	B	15
B	C, D	12
C	E	6
D	End	5
E	End	3
F	G, H	8
G	I, D	8
H	J	9
I	End	7
J	K	14
K	End	6

a. Draw the project diagram and determine the critical path.
b. Find the activity with the greatest slack.
c. Just as the project is about to begin, you are informed that activity B will now have 35 days duration, because of equipment failure at the subcontractor responsible for the activity. Discuss at least two different strategies you could use to complete the project as close to on-time as possible.

7. A small manufacturer of circuit boards must process a number of jobs through their facility. Three surface-mount machines with similar capabilities are available (Machines A, B and C). Each job is in a batch, but the batches cannot be split between machines. An initial allocation of jobs to machines is given below. All times are in seconds. Your manager has asked that the jobs be complete within 4 hours, otherwise customers may be lost.

   a. Develop a schedule with a makespan as close to 4 hours as possible.
   b. What is the average tardiness of your schedule?
   c. Prepare a **brief** memo to your manager about this situation.

Job number	Batch size	SM Machine time		
		Machine A	Machine B	Machine C
B2401	72	3100		
B7982	126	4400		
B6188	45		6000	
B1186	110	3800		
B9450	240			3800
B4053	32		4300	
B1848	32		4300	
B6294	32		4300	
B9981	192			1800
B1969	64		1200	
B3317	64		1200	
B8202	32		2900	
B4888	64		1000	
B7298	64		1000	
Total time:		11300	26200	5600