

**National Technical Examinations December 2008  
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)	(f)	(g)
1.	1	1	1	1	2	2	2
2.	4	6					
3.	5	5					
4.	10						
5.	5	5					
6.	5	5					
7.	3	3	4				

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**National Exams May 2008  
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1. Briefly define and discuss each of the following terms.
  - a. Craft production
  - b. Mass production
  - c. Lean production
  - d. Mass customization
  - e. Scientific management
  - f. Interchangeable parts
  - g. Division of labour
  
2. A produce distributor uses 800 non-returnable wooden crates a month, which it purchases at a cost of \$5 each. There is an annual holding cost of 25% of the price per crate. The ordering cost is \$28 per order, and orders are currently placed once per month.
  - a. Determine the optimal operating policy, and show why this policy is best.
  - b. The company has the option of using reusable plastic crates. These crates cost \$25 each. Assume that all crates are shipped and returned within a month, with the exception of 5% broken or lost crates per month. Broken crates have no salvage value. Considering only economic factors, are reusable crates justified? Are there other factors to be considered?
  
3. The table below shows two independent sets of forecasts based on judgment and experience, for the last 10 months. The actual demand is also shown.

Month	Demand	Forecast 1	Forecast 2
1	770	771	769
2	789	785	787
3	794	790	792
4	780	784	798
5	768	770	774
6	772	768	770
7	760	761	750
8	775	771	775
9	786	784	788
10	790	788	785

- a. Use appropriate metrics to determine which forecast is better.
- b. Calculate 2-Sigma control limits for Forecast 2 and determine whether it is in control.

4. A furniture company produces a variety of 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	\$180
Inventory (per month)	\$20
Back-order (per month)	\$100
Hiring cost (per worker)	\$1500
Firing cost (per worker)	\$1500

There are 5 workers, each making 30 chairs per month. The maximum production of chairs during overtime is 10 per month. Subcontracting can handle a maximum of 15 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. A new, high-powered cordless drill is composed of three sub-assemblies: K, L and W. K is assembled using 3 Gs and 4 Hs; L is made of 2 Ms and 2 Ns; and W is made of 3 Zs. On-hand inventories are 40 Gs and 200 Hs. Scheduled receipts are 10 Ks at the start of week 3 and 30 Ks at the start of week 6. One hundred drills must be shipped at the start of week 6, and another 100 at the start of week 7. Manufacturing lead times average about two weeks for subassemblies, and purchasing lead times are one week for components. Final assembly of the drill requires one week for 100 units. There is a 15% scrap rate for Ks. The minimum order size for H is 250 units. Other than component H, use lot-for-lot ordering.
- Draw a product structure tree.
  - Develop a material requirements plan for K, G and H.

6. In each of the following situations, discuss the use of MRP, CONWIP and Kanban production control systems. In each case, choose the best control strategy and support your decision.
- (a) An automobile manufacturer has introduced a new vehicle model, to begin shipping in September 2009. The vehicle will be available in 9 colours, 3 body types, and with 2 different engines. There are also 11 miscellaneous modifications that a buyer might request from the factory. A customer can buy a vehicle off the dealer's lot, or order the vehicle from the factory with any combination of the options listed. All factory orders are promised for delivery within a 21 day lead time. Dealer orders are placed well in advance of their delivery dates, usually 3 months before delivery is required. Customers can place orders at any time.
  - (b) An electronics manufacturer has created a new production line for their latest cell phone model UB47 with video capture and integrated mp3 player. The line includes both manual and automated assembly operations; all parts are obtained from external suppliers. The UB47 cell phone is expected to have a production lifetime of 18 months, after which it will be discontinued in favour of newer models. Demand forecasts have been produced, but there is significant uncertainty about the actual timing and levels of demand. The selling price of the phone may also decline dramatically over its lifetime, probably by at least 70%.

7. 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

- Draw the project diagram and determine the list of activities which should be monitored most closely to maintain timely completion.
- Calculate the slack on each activity.
- Just as the project is about to begin, you are informed that activity B will now have 25 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.