

**BITS PILANI, DUBAI CAMPUS**  
**Dubai International Academic City, Dubai**  
**Second Semester 2010-2011**

IV Year Mechanical  
 Time: 180 min.

Comprehensive Examination  
 ME C412 Production planning & control

Date: 07-06-2011

Weightage: 40%  
 Marks: 80

- I. Answer all the questions sequentially
- II. Assume suitable data, if required
- III. All questions carry equal marks (8x10=80 Marks)

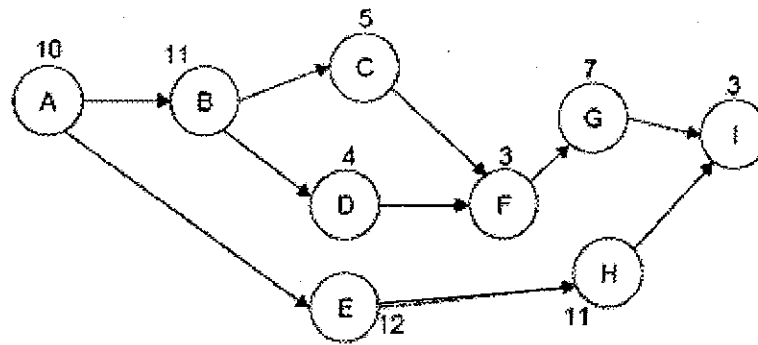
1. A firm can build a large plant or small plant initially (for a new product). Demand for the new product will be high or low initially. The probability of high demand is 0.6. (The probability of low demand is 0.4.) If they build "small" and demand is "low", the payoff is \$40 million. If they build "small" and demand is "high", they can do nothing and payoff is \$45 million, or they can expand. If they expand, there is a 30% chance the demand drops off and the payoff will be \$35 million, and a 70% chance the demand grows and the payoff is \$48 million. If they build "large" and demand is "high", the payoff is \$60 million. If they build "large" and demand is "low", they can do nothing and payoff is -\$10 million, or they can reduce prices and payoff is \$20 million. Determine the best decision(s) using a decision tree.

2. The company wants to know how much sugar on average is being put into this soft drink and how much variability there is in the sugar content in each bottle. To obtain this information, the company decides to sample 3 bottles of the soft drink at 3 different times each day: 10 A.M, 1:00 P.M. and 4:00 P.M. The data is given below.

Day	Hour	X1	X2	X3
1	10 am	17	13	6
	1 pm	15	12	24
	4 pm	12	21	15
2	10 am	13	12	17
	1 pm	18	21	15
	4 pm	10	18	17

Construct  $\bar{x}$  and R charts and write your inference.

3. Use the 'most following tasks heuristic' to assign to workstations. On the basis of the precedence diagram and activity times (in min.) given, the firm determines that there are 480 productive minutes of work available per day. Furthermore, the production schedule requires that 40 units be completed as output from the assembly line each day. Determine the cycle time, min. number of work stations and efficiency.



4. A company wants to enter the Latex Mattress market in Turkey. In order to learn how big is the market they want to estimate (forecast) the demand in 2008. They collect the following data and would like to forecast the demand for the first quarter of 2008 using different time series methods:

Time	1	2	3	4	5	6	7	8
Sales(in 1000's)	200	300	180	220	220	320	180	250

Note that for simplicity we choose to call 2006 Quarter1 as t=1, 2006 Quarter2 as t=2 and 2007 Quarter4 as t=8. Therefore the time period to be forecasted, 2008 Quarter1 is t=9. Using the past (8 quarters) data, answer the questions below and fill them in a table with your findings in parts a, b and c.

- Calculate the F9 (forecast for 2008 Quarter 1) using the following three time series methods: Naive, Moving average with  $n = 4$ , and Exponential Smoothing  $\alpha = 0.8$ .
- Calculate MAD for each of the forecasting methods.
- Which forecasting method do you recommend to the company using MAD values ?

5. The Masser is a new custom-designed sports car. An analysis of the task of building the

Task Name	Description	Immediate Predecessor(s)	Normal Time (days)
A	Design	--	8
B	Order special accessories	A	0.1
C	Build Frame	A	1
D	Build doors	A	1
E	Attach axles, wheels, gas tank	C	1
F	Build transmission and drivetrain	A	3
G	Fit doors to body shell	C, D	1
H	Build engine	A	4
I	Assemble chassis	E, F	1.5
J	Paint body	I	2
K	Accept delivery of special accessories	B	5
L	Mount body and accessories on chassis	J, K	1
M	Road test car	L	0.5

Masser reveals the following list of relevant activities, their immediate predecessors, and their duration:

- Draw a network diagram for the project.
- Find the critical path using ES, EF, LS, LF and slack time.

6. The following details are related to a manufacturing company.

Materials Cost: \$100/unit

Labor: 5 hours per unit, \$4/hr RT, \$6/hr OT

Subcontract \$20/unit (\$120 - \$100 matl savings)

Holding cost \$1.5/unit/month

Stockout cost \$5/unit/month (shortage cost due to insufficient inventory)

Hiring cost \$200; Firing cost \$250

Starting inventory 400 units

The demand is as follows:

Jan	Feb	Mar	Apr	May	June
1800	1,500	1,100	900	1,100	1,600

Use the following plans and find out the best option.

Hire and Fire, no OT: Plan 1

Constant Workforce: Plan 2

Subcontract: Plan 3

7. A Machine Shop is specialized in overhauling outboard marine engines. Some engines require replacement of broken parts, whereas others need a complete overhaul. Currently, five engines with varying problems are awaiting service. The best estimates for the labor times involved and the promise dates (in number of days from today) are shown in the following table. Customers usually do not pick up their engines early.

Engine	Labor time (days)	Promise Date (days from now)
1	5	8
2	4	15
3	10	12
4	1	20
5	3	10

Develop separate schedules by using the SPT and EDD rules. Compare the two schedules on the basis of average completion time, average tardiness and number of jobs tardy.

8. Complete the MPS table for products A and B

Product A : Beginning Inventory = 100; Lot Size: 100 units ; Lead Time: 1 week

Periods (Weeks)	1	2	3	4	5	6	7	8	9	10
Forecast	50	45	45	50	50	50	40	40	40	50
Customer Orders	25	60	15	55	25	35				
Projected on-hand inv.   100										
Planned Order Receipts										
Planned Order Releases										

Product B : Beginning Inventory. = 300; Lot Size : 100 units ; Lead Time: 1 week

Periods (Weeks)	1	2	3	4	5	6	7	8	9	10
Forecast	60	120	80	40	30	50	20	20	20	30
Customer Orders	35	150	60	30	25	35				
Projected on-hand inv.   300										
Planned Order Receipts										
Planned Order Releases										

**BITS PILANI, DUBAI CAMPUS**  
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**Second Semester 2010-2011**

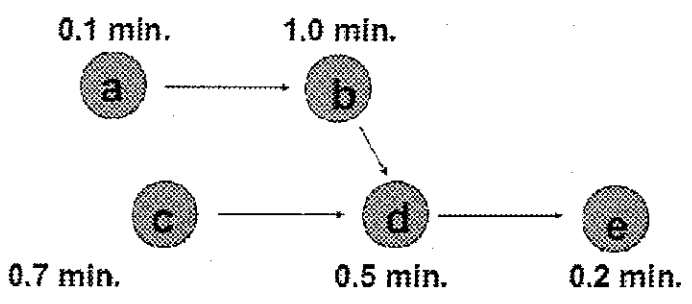
IV Year Mechanical  
**ME C412 Production, planning & control**

**Test 2 Open book**

Date: 24.04.2011  
 Time: 50 min.

Weightage: 20%  
 Marks: 40

#	1. Answer all the questions 2. Assume suitable data, if required 3. Text book, hand written class notes and statistical tables are permitted	Marks																											
1	<p>A large Portland manufacturer uses exponential smoothing to forecast demand for a piece of pollution control equipment. It appears that an increasing trend is present. Smoothing constants are assigned values of <math>\alpha = 0.2</math> and <math>\beta=0.4</math>. Assume initial forecast for month 1 as 11 units and the trend for that period as 2. Determine the exponential smoothed and adjusted exponential smoothed forecasts for the data given.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Month</th> <th style="text-align: center;">1</th> <th style="text-align: center;">2</th> <th style="text-align: center;">3</th> <th style="text-align: center;">4</th> <th style="text-align: center;">5</th> <th style="text-align: center;">6</th> <th style="text-align: center;">7</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Demand</td> <td style="text-align: center;">12</td> <td style="text-align: center;">17</td> <td style="text-align: center;">20</td> <td style="text-align: center;">19</td> <td style="text-align: center;">24</td> <td style="text-align: center;">21</td> <td></td> </tr> </tbody> </table>	Month	1	2	3	4	5	6	7	Demand	12	17	20	19	24	21		10											
Month	1	2	3	4	5	6	7																						
Demand	12	17	20	19	24	21																							
2	<p>The activities, time and their immediate predecessors in building construction are shown below.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Activities</th> <th style="text-align: center;">Time, Weeks</th> <th style="text-align: left;">Predecessors</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">2</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">3</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">2</td> <td style="text-align: center;">A</td> </tr> <tr> <td style="text-align: center;">D</td> <td style="text-align: center;">4</td> <td style="text-align: center;">A,B</td> </tr> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">4</td> <td style="text-align: center;">C</td> </tr> <tr> <td style="text-align: center;">F</td> <td style="text-align: center;">3</td> <td style="text-align: center;">C</td> </tr> <tr> <td style="text-align: center;">G</td> <td style="text-align: center;">5</td> <td style="text-align: center;">D,E</td> </tr> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">2</td> <td style="text-align: center;">F,G</td> </tr> </tbody> </table> <p>Construct AOA or AON network for the activities and determine LS, LF, ES, EF and slack times and critical path.</p>	Activities	Time, Weeks	Predecessors	A	2	-	B	3	-	C	2	A	D	4	A,B	E	4	C	F	3	C	G	5	D,E	H	2	F,G	10
Activities	Time, Weeks	Predecessors																											
A	2	-																											
B	3	-																											
C	2	A																											
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E	4	C																											
F	3	C																											
G	5	D,E																											
H	2	F,G																											

3	<p>The demand for sand required for a construction company averages 50 T. The demand follows normal distribution (assumption) and the standard deviation is 5 T. For a 97% (<math>z=1.88</math>) service level and a lead time of 10 days, determine the reorder point and safety stock.</p>	6															
4	<p>The number of units to be supplied for different destinations from a warehouse and the location are shown below.</p> <table border="1"> <thead> <tr> <th>Destinations</th> <th>x, y in km</th> <th>Weely quantity</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>2, 2</td> <td>800</td> </tr> <tr> <td>B</td> <td>3, 5</td> <td>900</td> </tr> <tr> <td>C</td> <td>5, 4</td> <td>200</td> </tr> <tr> <td>D</td> <td>8, 5</td> <td>100</td> </tr> </tbody> </table> <p>Determine the location for the warehouse for transporting the components with minimum cost.</p>	Destinations	x, y in km	Weely quantity	A	2, 2	800	B	3, 5	900	C	5, 4	200	D	8, 5	100	6
Destinations	x, y in km	Weely quantity															
A	2, 2	800															
B	3, 5	900															
C	5, 4	200															
D	8, 5	100															
5	<p>The activities related to toy manufacturing are shown below.</p>  <pre> graph LR     a((a)) --&gt; b((b))     c((c)) --&gt; d((d))     b --&gt; d     d --&gt; e((e))   </pre> <p>Operating time = 480min./day. Demand = 400 units/day. Determine cycle time, min. number of work stations required and line efficiency.</p>	8															

BITS, PILANI – DUBAI  
Second Semester 2010-2011

IV Year Mechanical

ME C412 Production, planning & control

Date: 06.03.2011

Time: 50 min.

Test 1

Weightage: 25%

Marks: 25

#	1. Answer all the questions 2. Assume suitable data, if required 3. Statistical tables are permitted	Marks
1	To absorb some short-term excess production capacity at its Arizona plant, <b>Special Instrument Products</b> is considering a short manufacturing run for either of two new products, a <b>temperature sensor or a pressure sensor</b> . Revenue of \$1,000,000 would be realized from selling the temperature sensor and revenue of \$400,000 would be realized from selling the pressure sensor. Development cost would be \$100,000 for the temperature sensor and \$10,000 for the pressure sensor. The probability of development success is considerably lower for the temperature sensor than it is for the pressure sensor (0.5 versus 0.8). Which sensor will be selected? Construct a decision tree for the problem.	6
2	The state ferry service charges \$18 per ticket plus a \$3 surcharge to fund planned equipment upgrades. It expects to sell 4,700 tickets <sup>weekly</sup> during the eight-week summer season. During that period, the ferry service will experience \$110,000 in labor costs. Materials required for each passage sold (tickets, a tourist-information sheet, and the like) cost \$1.30. Overhead during the period comes to \$79,000. a. What is the multifactor productivity ratio? b. If ferry-support staff work an average of 310 person-hours per week for the summer season, what is the labor productivity ratio? Calculate labor productivity.	5
3	A manufacturing process produces a certain part with a mean diameter of 2.01 inches and a standard deviation of 0.03 inches. The lower and upper engineering specification limits are $2.0 \pm 0.08$ inches. Determine the cp index of process capability. If 1000 components are produced every month, how much loss will be incurred if the rejection cost is 100AED/ component? What will be the loss if the process is centered?	5
4	There are at least two situations (faults) that may result in a computer not starting. (i) power failure (ii) booting failure ( $P=0.05$ ). Power failure, may result due to (i) the primary power source ( $P=0.12$ ) (ii) the uninterruptible power supply (UPS) is down ( $P=0.05$ ). Construct the fault tree for the case and determine the probability of the top event considering the probability of the events.	7
5	Specify the situations in which the different control charts are used. (x bar, Rbar, c, p)	2

**BITS PILANI, DUBAI CAMPUS**  
**SECOND SEMESTER 2010- 2011**

<b>Name:</b>	<b>ID No:</b>
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**IV Year Mechanical ME C412 Production, planning & control Quiz 2**

**Date: 09.05.2011**

**Weightage: 7%**

**Time: 20 min.**

**Marks: 14**

1	Compare product layout and process layout (use sketch)	2
2	Briefly explain service blueprinting	2
3	Briefly explain the type of inventory control systems	2
4	Explain the Gantt chart with an example	2
5	With a graphical illustration explain the time-cost relationship in project crashing.	3
6	Define GT, PDM and PLC	3



**BITS PILANI, DUBAI CAMPUS**  
**SECOND SEMESTER 2010- 2011**

<b>Name:</b>	<b>ID No:</b>
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**IV Year Mechanical ME C412 Production, planning & control Quiz 1**

**Date: 28.03.2011**

**Weightage: 8%**

**Time: 20 min.**

**Marks: 16**

1	Mention the risks of globalization	2
2	Mention any three benefits of e-business	2
3	List the factors to be considered related to sourcing in operations strategy.	2
4	Differentiate batch production and project.	2
5	List the dimensions of service quality	2
6	Construct the cause effect diagram for tool wear in machining.	2
7	Differentiate quality circles and Quality improvement teams	2
8	Construct a perceptual map for coffee and tea in terms of cost and taste	2