BA3320 Fundamentals of Production

EXAM 1 Fall 2005 Dr. Banis

NAME:
Section time:

Closed book, One page of notes. No team efforts. Consistent supporting calculations may be required for credit.

total 300 points

I

1) An example of intransitive preferences in deciding among alternatives is demonstrated by

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A. the minimax regret strategy.
B. decision trees.
C. the bologna factor.
D. the salami technique.
E. factor rating.
F. Ben Franklin's balance sheet approach.

2) The "Trunk Monkey" was shown as a possible example of

5

A. Customer-focused quality
B. Product failure half-life
C. Prisoner's Dilemma Model
D. Calculated Breakeven
E. Sensitivity Analysis
F. The Salami Technique in negotiation
G. Tit-for-tat strategy
H. Situational Optimism
I. The Golden Rule in TQM

3) A system has four identical components, with the same reliability. All three must work for the system to work. If you need an overall system reliability of about 0.656, what must the reliability of the individual components be?

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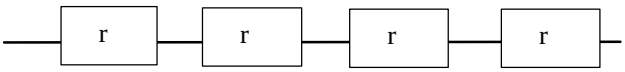

A. 0.344
B. 2.6244
C. 0.9
D. 0.857
E. 0.95
F. 0.164

4) In SPC, the number of products with defects is tracked using:

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A. A variometer invented by Cosby in 1973
B. The X-bar chart
C. The R-chart
D. The P-chart
E. The C-Chart
F. The Z chart
G. The pinPoint Table

5) A process filling tomato sauce jars gives mean volume of 32 ounces with a standard deviation of two ounces. If samples of 16 bottles (n=16) are tested for the X-bar chart and three sigma limits are used, what are the upper and lower control limits on the chart?

15

UCL=

LCL=

Total = 45

II A) Here is a system with 2 components, one of which has three backups. Some of the backup parts are a little less likely to work. The diagram looks like this, with the reliabilities indicated. What is overall reliability of the system?

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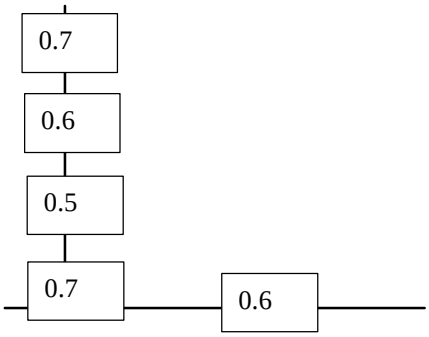

A. 0.7856
B. .5892
C. 1.275
D. 1.125
E. 0.71025
F. 0.546
G. 0.375
H. essentially 100%

15

2) You are selling Printers that have normally distributed lifetimes (before needing major service) with a mean of 8 years and standard deviation of 2 years.For those printers, instead of a warranty, you are selling a six-year service contract. If the average cost of a repair that would be covered by this contract is $100, how much should you charge for the whole six-year service contract to break even? Assume there is no other coverage for service, such as a warranty.

A. $100
B. about $84
C. $50
D. $15.87
E. $69
F. The printers won't break down until they are more than 12 years old

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3) 5) I'm considering buying a machine to automate binding of books. The current process has fixed costs of $500 per year and variable costs of $3 per book. The new equipment would raise fixed costs to $2500 per year, but would reduce variable cost to $1 per book. At what manufacturing volume (books/yr) would I be indifferent between the two options? Show calculations and put the answer in the box to get full credit.

books per Year

15

4) A parking sticker costs $17 per semester credit hour. You are taking four 3-hour courses this semester and will park on campus 40 days this semester. A parking citation ("ticket") would cost $75.
If the probability of getting a ticket, per parking session, were 10%, would you be better off purchasing a sticker or taking your chances?

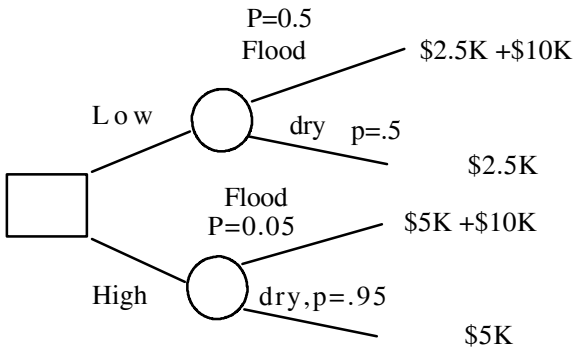
Suppose, even if you purchased a sticker, there were a 50% probability of not finding a "permitted" space, so that even after buying the sticker you were at risk of getting a ticket (P=50%*10%) should you purchase a sticker?

Is reducing the number of parking spaces a good plan for raising revenue from sale of parking stickers? Why do you say this?

Total = 60

III *Effects of Government Flood Insurance on location decisions:*

This example is based on information in a special section of the Post-Dispatch on November 11, 1993
You can choose to build a house near the Missippi River either in a low location at a cost of $20,000 , or in a higher location at a cost of $40,000. Amortized over 20 years, this is to a cost per year of $2,500 for low or $5,000 for high. In a low location, the property is likely to be flood damaged every 2 years (P=0.5), with a repair cost of $10,000. This same damage would occur in the high location only every 20 years (P=0.05). Here is a decision tree for building on a flood plain vs. building in a higher location based on annual cost.



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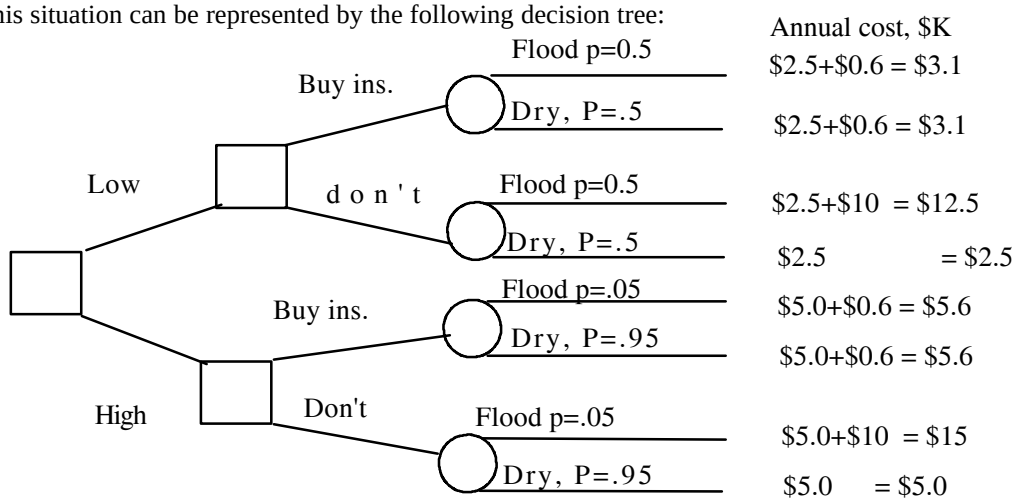
A) Under these circumstances, assuming the initial construction cost is no more a barrier than the risk of damage, where would a rational decision maker choose to build? (credit depends on calculation of EMV)

Insurance for flood damage is available from the government for a cost of $600 per year. If a person decides to purchase this insurance, then "the government" will bear the burden of any damage caused by the floods.
This situation can be represented by the following decision tree:



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B) Calculate EMV's for both location alternatives. Assuming all the costs (including inconvenience,etc.) are captured in these numbers, where would a rational decision maker choose to build under these circumstances?

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C) What would happen if flood insurance were provided only by private companies at rates that reflect the losses. Would builders be more or less interested in building on flood plains? Why do you say this?

Total = 50

IV

Jane and John are breaking up their partnership and dividing up all their joint equity.

There are three stategies each can pursue:

A. Amicable dissolution attempting to maintain value through negotiated distribution. John is a little less aware of values and may come out on the shorter end of this.
B. Hardball, spiteful division in which assets may be split in a way to lose substantial value (e.g. each takes half of the dining room table, half of the kitchen table).
C. Retain attorneys and go for blood. A person can win this way, but only if the other party doesn't do the same thing. If both try to "win" at the other person's expense, they both lose and the assets are eaten up in legal fees.

Jane controls which row will be picked. John controls which column.

Retained assets for each at the end of the breakup

Jane / / John	amicable	Spiteful	Attorneys	John's Maximum Assets
amicable	350 / / 200	200 / / 250	10 / / 230	
Spiteful	375 / / 90	325 / / 100	35 / / 200	
Attorneys	400 / / 10	400 / / 15	80 / / 80	
Jane's Maximum assets				

30

(please note if you end up with a stable solution of amicable/amicable, you've done it backwards--life doesn't work that way.)

15

Use squares for Jane and circles for John to show which strategies would prevail if each party only chose to maximize short term gain. How much would each end up with in the stable solution?
Show, by drawing lines through those rows and columns, which strategies are dominated and wouldn't be pursued in any case.

What would be a better solution for them both? If they think about it, do they have incentives to maintain that better solution? What effect will this history have on acquisition of possible future partners?

5

Total = 50

V

Risky investments and Powerful Payoffs:

Generally, riskier investments give higher rewards on average, else people would have no incentive to select them over less risky investments.

Which alternative would maximize Expected Monetary Value (EMV) ?
Which alternative would you choose under: the Maximax (optimist) strategy ?
the Maximin (pessimist) strategy ?

10 What is the most you would pay for perfect advance information about the market for each market period?

Total profit as a function of market conditions this period ($M)

	Total profit ($M)					
Market conditions	Low	medium	High	EMV	Optimist	Pessimist
Probability	0.4	0.5	0.1			
conservative	18	18.2	18.5			
Moderate risk	14	20	30			
High Roller	2	20	50			
EMVc						

15

Which would you choose under the Minimax regret strategy ?

regrets

	Total profit ($M)			
Market conditions	Low	medium	High	Maxregret
conservative				
Moderate risk				
High Roller				

15

What is the difference in expected profit for following an EMV strategy vs. Minimax Regret in this case?

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Total = 50

VI

Linear Programming, Computer solution - Product mix and sensitivity analysis

Variety Industries can make a mixture of skis, umbrellas, natural colored ties in wooden presentation boxes, mulch and fruit pies. The most limiting resources are wood, sheet aluminum, cloth, boysenberries and labor. The amounts--in pounds and hours --used for each unit of each product is shown in the table. Oscar Optimizer, the corner operations scientist, has analyzed this situation using linear programming, and provided a simplified computer printout.

Computer Printout--the model

	Skis	Umbrellas	Ties	Mulch	Fruit Pie		RHS= Available
Unit Profit-->	30	12	15	2	3		
constraint							
Wood	5	1	1	10	0	<=	150
Aluminum	1	1	0	0	0	<=	40
Cloth	1	2	4	0	0	<=	100
Berries	0	0	1	0	3	<=	200
Labor	10	7	6	5	2	<=	500

A) What is the optimal production plan and what would the profit be for that plan?

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B) How much could the profit on mulch drop before it would be worthwhile to change the plan?

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Computer Printout--Range of Optimality for Objective Function Coefficients

Variable	Value	Current Coefficient	Lower Limit	Upper Limit
Skis	26	30	16	45
Umbrellas	0	12	-infinity	15
Natural ties	22	15	12	129
Mulch	0	2	-infinity	37
Fruit pies	56	3	1	5

Objective Function Value = 1265.38462

C) Suppose someone offered $2 per unit for your cloth? How many units are you sure you should sell?

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D) Suppose someone offered to sell you more labor for $380 per hour. How many hours are you sure you should buy?

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Computer Printout--Range of Validity for Shadow Prices

Constraint	RHS	Slack	Shadow Price	Lower Limit	Upper Limit
Wood	150	0	3	147	209
Aluminum	40	14	0	26	infinity
Cloth	100	0	1	93	210
Boysenberries	200	9	0	191	infinity
Labor	500	0	2	387	506

5

E) How high could the profit on fruit pies go before you should change the plan?

10

F) Suppose someone offered $4 per unit for your wood? How many units are you sure you should sell?

Total = 50