

Preview of MgS 3100 Exam 1  
(Closed Book Test, one sheet of notes (both sides) allowed!)

## General Modeling Questions

Multiple choice questions similar to the following from the practice final:

Directions for Problems 1 and 2: Shirley Hess and her longtime friend Rick Moncrief have developed a hot new product. It is a color fax board for use in PC's. They see two fundamentally different ways they could manufacture it. The conventional way would be to use existing chips currently available on the open market. The alternative is to use ASIC's (Application Specific Integrated Circuits). The costs they have been able to estimate, with the help of their bookkeeper, are:

	ASIC Based	Conventional
ASIC Setup	200,000	0
Board Setup	10,000	10,000
Plant Operations	200,000	200,000
Marketing	250,000	250,000
Software/Unit	5	5
Manual/Unit	1	1
Packaging/Unit	1	1
Board/Unit	1	2
Labor/Unit	2	8
Chips/Unit	2	5
Overhead/Unit	6.6	4.6

Shirley and Rick are not willing to count on more than a two year life for the product in this fast moving industry. The bookkeeper allocated fixed costs for those two years on the assumption that 100,000 color fax modems would be sold in those two years.

- Find the break-even point (in units) of a color fax modem (ready to ship) for the ASIC manufacturing method assuming that they plan to sell the units for \$59 each.  
A) 4590      B) 8000      C) 10984      D) 14043      E) 20000
- Find the number of units at which Shirley and Sal should be indifferent between the two methods.  
A) 4590      B) 8000      C) 10984      D) 14043      E) 20000
- Which of the following is true in general?  
A) At breakeven, total profit and total revenue are equal  
B) At breakeven, total profit is equal to total cost  
C) At breakeven, total profit is maximized  
D) At breakeven, total profit cannot be negative  
E) At breakeven, the total profit for two options is the same

10. A product sells for \$25 and the manufacturer has total fixed costs of \$20,000 and a per unit variable cost of \$13. If the firm decides to increase production by one unit, and all units that are produced will be sold, by what amount (in dollars) will profit increase?

- A) 0
- B) 12
- C) 13
- D) 25
- E) 1667

19. The advantage of a spreadsheet model over a paper and pencil model is that it is easier for the user to change the parameters to develop answers to “what-if” questions.

- A) True
- B) False

24. When developing the equations for a model, the values of all parameters must be embedded in the equations of which they form a part.

- A) True
- B) False

26. A model using data, variables, and mathematical relationships to represent abstracted situations, such as a model of a country’s economy, is called:

- A) An analog model
- B) A black box model
- C) A physical model
- D) A symbolic model
- E) An exogenous model

## Monte Carlo Simulation Questions

25. The all Washed-Up Car Wash has found a tremendous bargain on a new car waxing machine imported from the newly independent Republic of Lowenbrau. The only weak point is the special wax pump, which can be expected to fail relatively frequently and cannot be repaired. AWUCW can order up to five replacement pumps at a time, which would be delivered with the annual end of year shipment from Lowenbrau. They are available at no other time, and are expensive. If the wax pump fails and they have no replacement, they must stop using the machine until the next shipment arrives. The probabilities of breakdowns during any given year are given below:

<u>Breakdowns per year</u>	<u>Probability</u>
0	0.30
1	0.25
2	0.15
3	0.12
4	0.10
5	0.08
Sum	1.00

In an average year, how many pumps can they expect to fail?

- A) 0      B) 1.71      C) 2.25      D) 4.81      E) 5.00

25.1 . Using the data for Problem 25, develop random number ranges to represent each level of demand, beginning the first random number range with 0.00 (zero), and ending with 0.999. Which of the following statements is true?

- The random number range for breakdowns = 4 is 0.66-0.85.
- The random number range for breakdowns = 3 is 0.40-0.65.
- The random number range for breakdowns = 5 is 0.85-0.99.
- The random number range for breakdowns = 2 is 0.55-0.70.
- The random number range for breakdowns = 5 is 0.01-0.85.

25.2 Using the data for Problem 25, suppose the random number .59 has been selected for one particular simulated year; how many simulated breakdowns occur in that simulated year?

- A) 1      B) 2      C) 3      D) 4      E) 5

39. The random number 0.57 has been selected. The corresponding observation,  $r$ , from the following discrete probability distribution would be:

$r$	$P(r)$
0	0.30
1	0.20
2	0.40
3	0.10

- A) 0      B) 1      C) 2      D) 3      E) None of these

40. The number of machine breakdowns in a day is 0, 1, or 2, with probabilities 0.6, 0.3, and 0.1, respectively. The following random numbers have been generated: 13, 10, 02, 18, 31, 19, 32, 85, 31, 94. Use these numbers to generate the number of breakdowns for 10 consecutive days. What proportion of these days had at least 1 breakdown?

- A) 0.2      B) 0.3      C) 0.4      D) 0.5      E) 0.6

51. Selling price per unit is \$35; Variable cost per unit is \$8; Salvage value per unit is \$3; Cost of lost sales is \$2 per unit. Find the profit ( $\pi$ ) when 50 units are produced and the state of nature is a demand of 60 units. Do not include fixed costs.

- a.  $\pi = 35 \cdot 60 - 8 \cdot 60 + 3 \cdot 10$
- b.  $\pi = 35 \cdot 50 - 8 \cdot 50 - 2 \cdot 10$
- c.  $\pi = 35 \cdot 50 - 8 \cdot 60 + 3 \cdot 10$
- d.  $\pi = 35 \cdot 60 - 8 \cdot 50 + 3 \cdot 10 - 2 \cdot 10$
- e.  $\pi = 35 \cdot 50 - 8 \cdot 50 + 3 \cdot 10 - 2 \cdot 10$

52. Using the data of Question 51, Find the profit ( $\pi$ ) when 60 units are produced and the state of nature is a demand of 50 units. Do not include fixed costs.

- a.  $\pi = 35 \cdot 60 - 8 \cdot 60 + 3 \cdot 10$
- b.  $\pi = 35 \cdot 50 - 8 \cdot 50 - 2 \cdot 10$
- c.  $\pi = 35 \cdot 50 - 8 \cdot 60 + 3 \cdot 10$
- d.  $\pi = 35 \cdot 60 - 8 \cdot 50 + 3 \cdot 10 - 2 \cdot 10$
- e.  $\pi = 35 \cdot 50 - 8 \cdot 50 + 3 \cdot 10 - 2 \cdot 10$

53. A club has 15 members. Each month, the number of new members joining the club follows the first probability distribution shown at left. The number of old members leaving the club follows the second probability distribution shown at right.

New members Joining	Probability
7	.20
8	.30
9	.30
10	.20

Old members leaving	Probability
6	0.10
7	0.55
8	0.25
9	0.10

Simulate three months changes in club membership. Use the following random numbers for new members joining: 52, 06, 28, and for old members leaving: 53, 88, 47.

Month	Random #	Joining	Random #	Leaving	Membership at end of month
Membership at start of month					<b>15</b>
month 1	15				
month 2					
month 3					

How many members are in the club at the end of month 3?

- a. 13
- b. 14
- c. 15
- d. 16
- e. 17