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Review Material for Second Exam

The exam is scheduled to take 90 minutes. One question will be a decision tree problem, and the other a simulation spreadsheet.

You will have to work out the decision tree problem by hand, although you may use a calculator. I regret that I do not have any practice material for that portion of the test (the other courses in which I have taught decision trees have not covered exactly the same material).

The following two sample questions should be fairly representative of what you may expect to see on the spreadsheet simulation question.

1: Staffing an Office

You operate an office that handles requests for medical documentation from insurance companies. The number of requests you get per day varies randomly, following a Poisson distribution with a mean of 225. Most requests require 5 minutes to process, but each one has a 30% probability, independent of all other requests, of becoming a “level 2” request that requires 15 additional minutes of processing.

You would like to operate the center at the minimum possible average cost per day, and are trying to decide whether to hire 3, 4, 5, or 6 workers to process the requests. Each worker receives a \$175 daily salary, for which they will work up to 7 hours. Each worker can work an additional 2 hours of overtime for \$37.50 per hour. If further labor is required to finish the day’s requests, it must be obtained from a “temp” agency that charges \$60 per hour.

To help make your decision, you are using the following simulation spreadsheet:

- (a) What formula should be in cell B11, for the number of workers hired?**
- (b) What formula should be in cell B13, the number of requests received?**
- (c) What formula should be in cell B14, the number of requests that become “level 2”?**
- (d) What formula should be in cell B15, the total hours of work needed to process the day’s requests?**
- (e) What formulas should be in cells B17:B19, the number of regular-time hours worked, the number of overtime hours worked, and the number of temp agency hours, respectively?**

	A	B
1	Average Demand	225
2	Probability of Level 2	0.3
3	Minutes per Level 1 Request	5
4	Extra minutes per Level 2 Request	15
5	Hours per Worker	7
6	Worker Base Salary	\$ 175.00
7	Max Overtime Hours per Worker	2
8	Overtime Hourly Rate	\$ 37.50
9	Temp Agency Hourly Rate	\$ 60.00
10		
11	Workers Hired	4
12		
13	Number of Requests	223
14	Level 2 Requests	75
15	Total Hours of Work	37.333
16		
17	Hours of Regular Work	28.000
18	Hours of Overtime Work	8.000
19	Hours of Temp Agency Work	1.333
20		
21	Total Cost	\$ 1,080.00

(f) What formula should be in cell B21, the total cost of the day’s operations?

(g) Consider the simulation output report below. How many workers should you hire?

YASAI Simulation Output						
Workbook	staff-office.xls					
Sheet	Sheet1					
Start Date	11/15/01					
Start Time	10:01:58 AM					
Run Time (h:mm:ss)	0:00:18					
Scenarios:	4					
Sample Size:	1000					
		Parameter				
	Scenario	Workers Hired				
	1	3				
	2	4				
	3	5				
	4	6				
				Standard		
	Output Name	Scenario	Observations	Mean	Deviation	
	Total Cost	1	1000	1271.586	178.463	
	Total Cost	2	1000	1012.104	144.385	
	Total Cost	3	1000	933.683	75.169	
	Total Cost	4	1000	1050.881	7.883	

2: Chickens and Eggs

You run a country inn that offers guests the authentic experience of staying on a working farm. You have room for up to 10 guests, and your recent occupancy pattern has been as follows:

Guests:	0	1	2	3	4	5	6	7	8	9	10
Probability:	1%	1%	3%	5%	10%	12%	14%	16%	15%	14%	9%

One of your dining room’s signature dishes is its “laid fresh that day” special two-egg breakfast, made with eggs collected just that morning. Each guest has a 55% chance, independent of all other guests, of ordering this breakfast.

Until now, you have bought all the fresh eggs for these breakfasts from your neighbor, an organic poultry farmer, for \$0.70 each. Now, you have decided to keep your own chickens as well. You estimate the daily cost of keeping a chicken to be \$0.20. Each night, each chicken lays an egg with probability 43%, independent of all the other chickens.

Each morning, if your chickens lay fewer eggs than you need for the special breakfasts, you will buy the rest from your neighbor at the normal \$0.70 price. If your chickens lay more fresh eggs than you need, you will use the extra ones in place of regular store-bought eggs in the rest of your cooking operation, which saves you \$0.15 per egg.

You have already decided to keep between 10 and 20 chickens, and you are trying to determine which exact number in this range would be economically best, using the YASAI simulation model below.

	A	B	C	D	E
1				Guests	Probability
2	Chance each guest orders eggs	55%		0	1%
3	Eggs per order	2		1	1%
4	Chance each chicken lays egg	43%		2	3%
5	Cost per day to care each chicken	\$ 0.20		3	5%
6	Cost per egg from neighbor	\$ 0.70		4	10%
7	"Salvage" value of unused eggs	\$ 0.15		5	12%
8				6	14%
9	Number of chickens kept	19		7	16%
10				8	15%
11	Guests staying	8		9	14%
12	Guests ordering eggs	4		10	9%
13	Eggs needed	8			
14	Eggs laid	9		Possible Numbers	
15	Own eggs served	8		of Chickens	
16	Eggs bought from neighbor	0		10	
17	Eggs not used	1		11	
18				12	
19	Cost of keeping chickens	\$ 3.80		13	
20	Cost of eggs from neighbor	\$ -		14	
21	Credit for extra eggs	\$ 0.15		15	
22	Net Cost	\$ 3.65		16	
23				17	
24				18	
25				19	
26				20	

- (a) What formula should be in cell B9, for the number of chickens kept?
- (b) What formula should be in cell B11, the number of guests staying at the inn?

- (c) What formula should be in cell B12, the number of guests ordering the special two-egg breakfast?
- (d) What formula should be in cell B13, the number of eggs needed for special breakfasts?
- (e) What formula should be in cell B14, the number of eggs laid?
- (f) What formula should be in B15, the number of your own eggs used for special breakfasts?
- (g) What formula should be in cell B16, the number of eggs you had to buy from your neighbor?
- (h) What formula should be in cell B17, the number of your own fresh eggs you couldn't use in special breakfasts?
- (i) What formulas should be in cells B19:B21, which represent respectively the cost of keeping the chickens, the cost of buying eggs from your neighbor, and the amount saved by using extra fresh eggs in place of store-bought eggs?
- (j) What formula should be in cell B22, which is the total cost minus the \$0.15 credit for extra fresh eggs?
- (k) Consider the simulation output report below. How many chickens would it be best to keep?

		Parameter	
Scenario	Number of chickens kept		
1	10		
2	11		
3	12		
4	13		
5	14		
6	15		
7	16		
8	17		
9	18		
10	19		
11	20		

Output Name	Scenario	Observations	Mean	Standard Deviation
Net Cost	1	5000	4.307	2.315
Net Cost	2	5000	4.209	2.279
Net Cost	3	5000	4.232	2.232
Net Cost	4	5000	4.244	2.172
Net Cost	5	5000	4.218	2.071
Net Cost	6	5000	4.201	2.005
Net Cost	7	5000	4.236	1.982
Net Cost	8	5000	4.264	1.900
Net Cost	9	5000	4.289	1.842
Net Cost	10	5000	4.342	1.745
Net Cost	11	5000	4.384	1.657