Solution to Homework Set #7

ENCE 627 – Decision Analysis for Engineering - Fall 2003

Assigned T, 11/4 Due T, 11/11

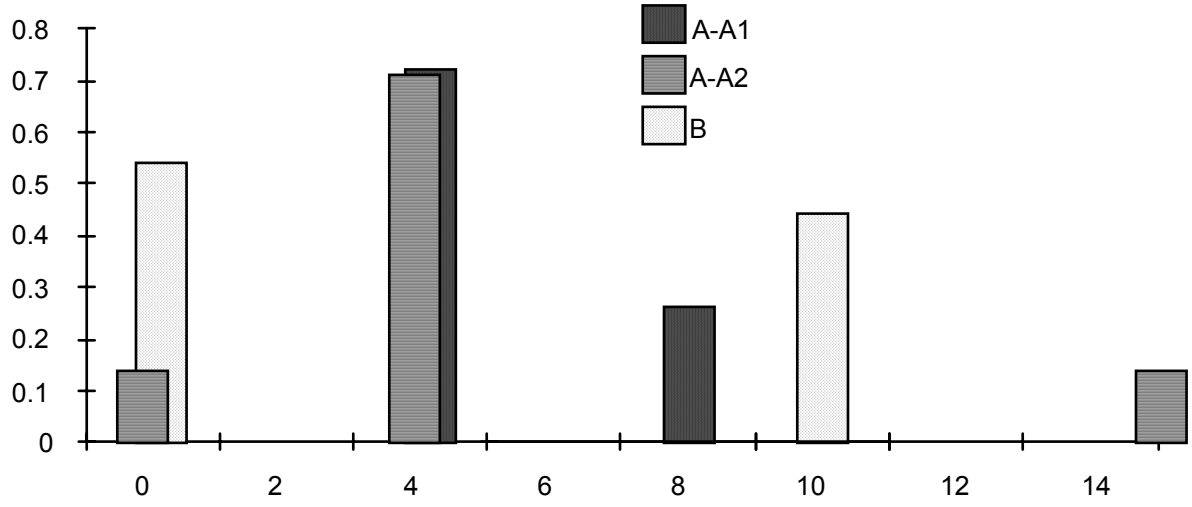
Problem 1

Textbook (CR): 4.9

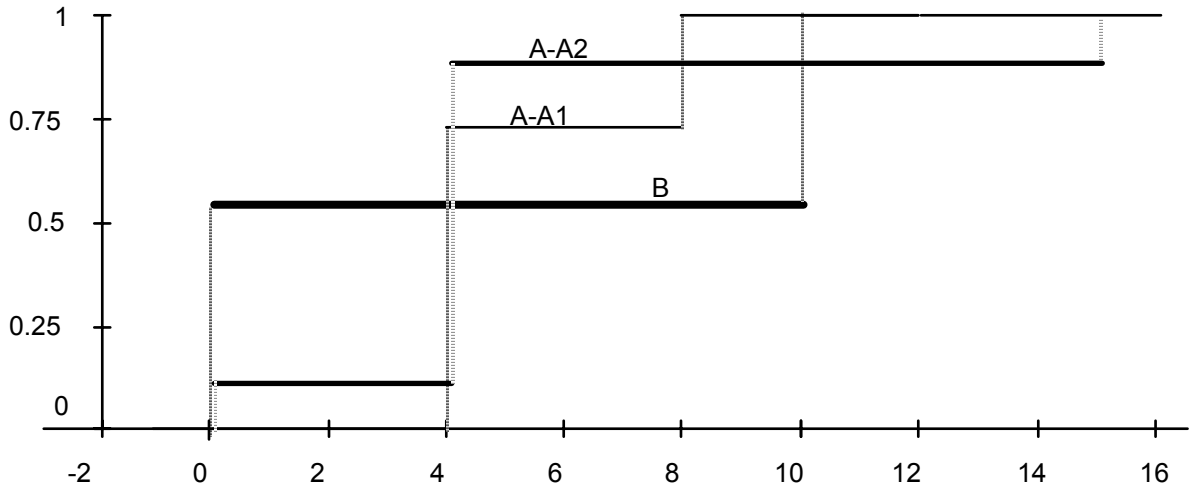
***** SOLUTION *****

The following risk profiles were generated by hand. The profiles generated by PrecisionTree only include the two primary alternatives defined by the original decision "A" or "B". To also include the A-A1 and A-A2 distinction, the decision tree would need to be restructured so that there was only one decision node with three primary alternatives, "A-A1", "A-A2", and "B".

Risk profiles:



Cumulative risk profiles:



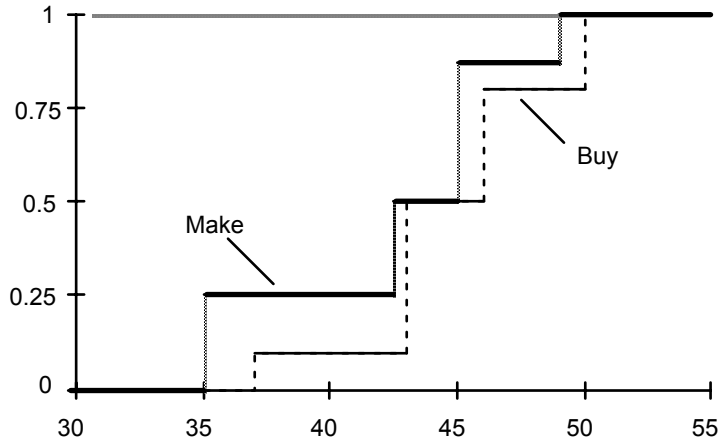
None of the alternatives is stochastically dominated (first-order) because the cumulative risk-profile lines cross.

Problem 2

Textbook (CR): 4.16

***** SOLUTION *****

The cumulative risk profile generated by PrecisionTree is shown in the second worksheet. Cumulative risk profiles:



Johnson Marketing should make the processor because the cumulative risk profile for "Make" lies to the left of the cumulative risk profile for "Buy." (Recall that the objective is to *minimize cost*, and so the leftmost distribution is preferred.) Making the processor stochastically dominates the "Buy" alternative.

Problem 3

Textbook (CR): 4.18

***** SOLUTION *****

a. Stacy has three objectives: minimize distance, minimize cost, and maximize variety. Because she has been on vacation for two weeks, we can assume that she has not been out to lunch in the past week, so on Monday, all of the restaurants would score the same in terms of variety. Thus, for this problem, we can analyze the problem in terms of cost and distance. The following table gives the calculations for part a:

	Distance	Distance Score	Cost	Cost Score	Overall Score
Sam's	10	0	$3.50	89	45
Sy's	9	13	$2.85	100	56
Bubba's	7	38	$6.50	41	39
Blue China	2	100	$5.00	65	83
Eating	2	100	$7.50	24	62
Excel-Soaring	5	63	$9.00	0	31

In the table, "Distance Score" and "Cost Score" are calculated as in the text. For example, Sam's cost score is calculated as 100(3.50 - 9.00)/(2.85 - 9.00) = 89. The overall score is calculated by equally weighting the cost and distance scores. Thus, S(Sam's) = 0.5(0) + 0.5(89) = 45. The overall scores in the table are rounded to integer values.

Blue China has the highest score and would be the recommended choice for Monday's lunch.

b. Let's assume that Stacy does not go out for lunch on Tuesday or Wednesday. For Thursday's selection, we now must consider all three attributes, because now variety plays a role. Here are Stacy's calculations for Thursday:

	Distance	Distance Score	Cost	Cost Score	Variety Score	Overall Score
Sam's	10	0	$3.50	89	100	63
Sy's	9	13	$2.85	100	100	71
Bubba's	7	38	$6.50	41	100	59
Blue China	2	100	$5.00	65	0	55
Eating	2	100	$7.50	24	100	75
Excel-Soaring	5	63	$9.00	0	100	54

The score for variety shows Blue China with a zero and all others with 100, reflecting Monday's choice. The overall score is calculated by giving a weight of 1/3 to each of the individual scores. Now the recommended alternative is The Eating Place with an overall score of 75.

If we assume that Stacy has been out to eat twice before making Thursday's choice, then the table would have zeroes under variety for both Blue China and The Eating Place, and the recommended choice would be Sy's.

Note that it is necessary to do the calculations for part b; we cannot assume that Stacy would automatically go to the next best place based on the calculations in part a. The reason is that a previous choice could be so much better than all of the others on price and distance that even though Stacy has already been there once this week, it would still be the preferred alternative.

Problem 4

Textbook (CR): 5.7

***** SOLUTION *****

Cost of protective action = C

Expected loss if no action taken = pL

Set $C = pL$, and solve for p: $p = \frac{C}{L}$.

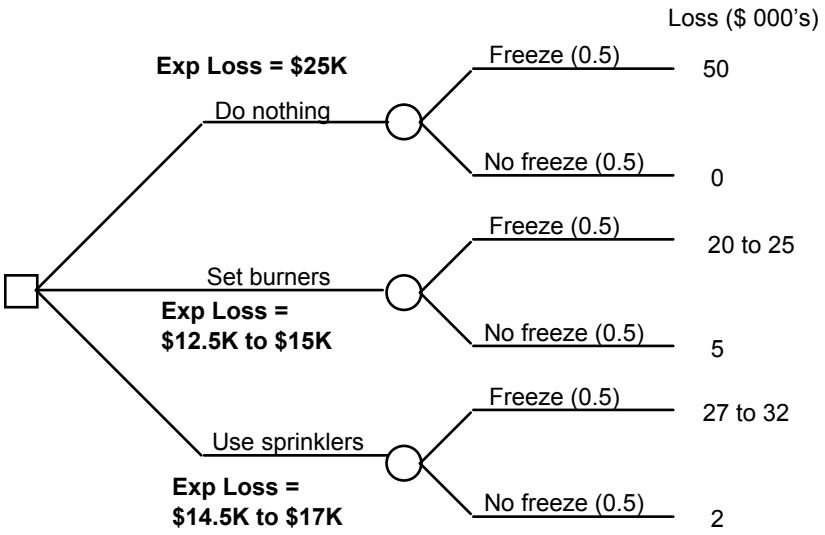
Thus, if $p \geq \frac{C}{L}$, take protective action.

The only information needed is p and $\frac{C}{L}$. Note that the specific values of C and L are not required, only their relative values.

Problem 5

Textbook (CR): 5.9

***** SOLUTION *****



The expected loss from doing nothing is much greater than for either of the two measures, and so it is certainly appropriate to take some action. The expected loss for burners is almost entirely below that for sprinklers, the only overlap being between $14.5K and $15K. It would be reasonable to set the burners without pursuing the analysis further.

Another argument in favor of this is that most likely the same factors lead to more or less damage for both burners and sprinklers. With this reasoning, there would be a negligible chance that the burners would produce a high loss and the sprinklers a low loss.

A final note: Some students may solve this problem without calculating the expected loss, comparing the range of losses from burners or sprinklers if damage occurs with the $50K loss from doing nothing. However, if uncertainty about the weather is ignored altogether, the appropriate analysis has the loss ranging from $0 to $50K for no action, $5 to $25K for the burners, and $2 to $32K for the sprinklers. Because the three ranges overlap so much, no obvious choice can be made. It is, therefore, appropriate and necessary to include the probability of adverse weather and calculate the expected losses. This decision tree is modeled in the Excel file "Problem 5.9.xls" and the sensitivity analysis dialog box has the parameters saved.