

Homework #4

1. As a manager of a private equity firm, you would like to select your overall business strategy for next year. Unfortunately, you are uncertain about the upcoming economic conditions. Given the uncertainty, you have narrowed the choice down to three strategies: aggressive, basic, and cautious, which require investments of \$15M, \$10M, and \$5M, respectively. Next year's economy may be broadly classified as either strong or weak, and you believe there is a 40% chance that it will be strong. Revenue from implementing your strategy and the prevailing economic conditions have been forecasted as follows:

	Information (Data)					Decision			
	Environment e =					Environment e			
Prior Probabili	Strong (s)	Weak (w)		Payoff Table	R _d (e)	e = strong	e = weak	Investment	
P(e)	0.4	0.6			A	\$45.00	\$5.00	\$15.00	
				Decision d =	B	\$25.00	\$20.00	\$10.00	
					C	(\$5.00)	\$25.00	\$5.00	

- a. Draw a decision tree that represents the above problem with necessary information. Then, decide which strategy to select so as to maximize your EMV.
 - b. Suppose that prior to selecting a strategy, you can consult *Seefar* (발음주의, 오해금지!), an economic research firm, which provides either “good” or “bad” signal (with 50%/50%) of future economic conditions. Their past record shows that 80% of the time they had correctly predicted strong economy with a good signal; 20% of the time they had incorrectly signaled it would be bad. Their record for forecasting weak economy was slightly worse: only 70% of the time they had accurately called weak economy bad. Seefar charges an upfront fee of \$3M for their forecasting services. Draw a decision tree that represents this problem (with the option to consult Seefar). Should you hire the services of this firm?
2. Consider a class of 30 students. Surprisingly, the probability that at least two of them will have same birthday turns out to be more than 70%. To demonstrate this by simulation, let’s randomly generate each person’s birthday. Count the number of matches among the 30 students; if more than two students have the same birthday count it as one match.
- a. Simulate the above situation 1000 times and determine the probability distribution of the number of matches. In particular, compute the chances that at least two persons have the same birthday.
[Hint: Use =RANDBETWEEN(1,365) to generate a random birthday; i.e., an integer between 1 to 365. In addition, use =COUNTIF function to “count” a match that meets certain criteria.]
 - b. What is the average number of birthday matches? What is the standard deviation?
 - c. Draw the probability distribution of birthday matches for the 30 student classroom.

3. Consider the “Revenue Management” problem discussed during the class. Re-solve the problem by using the normal approximation; i.e., use the normal distribution to simulate the number of no-shows (or number of shows) from 330 ticket holders, where no-show probability for each ticket holder is 0.1. Assume all other factors remain identical as the before.

- a. Characterize the information of the normal distribution suitable for this problem.
- b. Run the simulation based on the above normal distribution. To provide robustness in our simulation, let’s set the number of simulation to 5,000! What is the optimal solution; i.e., optimal number of tickets to sell and the corresponding revenue?
[NOTE: it will take some time for your computer to handle this scale of problem]
- c. Compare the normal approximation simulation result with the original simulation (using binomial distribution with 5,000 runs). Is this a reasonable approximation? What do you think?

4. Suppose you are on the job market search. Also, suppose that the average salary offer for SNU undergraduate students in the job market is KRW 50,000,000 with a standard deviation of 5,000,000 (following normal distribution). For simplicity, assume you will receive a job offer exactly once a week, and must decide either to accept it or to turn it down (in the hope of receiving a better offer later); that is, each job will only give you one week for your acceptance/rejection decision.

After taking the *Management Science* course, you would like to determine an optimal strategy for accepting a job offer. In particular, you would like to set a “reservation level” in terms of salary, which is the minimum salary level that you will accept the job. Let’s assume all other non-financial aspects are ignored. If you set a very high reservation level, it is likely that you will eventually end up with a high paying job, but it may take a long time to receive such an offer. You feel that each week that goes by without a job costs you KRW 100,000 in terms of “job search costs”, including any psychic costs of being jobless. Search cost occurs in the beginning of each week.

- a. Determine the optimal reservation salary level that maximizes your payoff net of the search cost. Specifically, obtain the optimal strategy via simulation. Consider until week 100, and simulate the job search process 500 times. Consider the reservation levels between KRW 50,000,000 to KRW 65,000,000 in the increments of 1,000,000 (i.e., KRW50,000,000, KRW51,000,000, KRW52,000,000,...).
- b. How would the model and solution change if there is no search cost but there is a time-discount factor of 0.5%?