Decision Analysis Final

1) You own a piece of land where a historic site is located. You are trying to build a high density apartment complex on this land but fear for a backlash from the public. After thoughtful consideration, you estimate the following scenario. There are three options; you could request the apartment permit, you could sell the land or you could request a permit for a low density office building, which the public indicated they would not fight. Regarding the last two options, if you sell the property, you think you can get $900,000. If you build a new office building, its return will depend on town business growth in the future. You think there is a 70% chance of growth, in which case you will see a return of $1.3 million; if not then you will only make $200,000.

   If you apply for a permit for apartments, you estimate that there is a 10% chance of getting approval which in turn may result in a return of $3million. However, you think there is also a 90% chance of your permit being rejected. If your permit gets rejected you can sell the property at $700,000 or build an office building with 30% chance of no growth and $200,000 or 70% chance growth with $1.3million. The final option is to sue the city at a cost of $300,000. You feel like there is a 40% chance of winning the law suit, in which case you will get $1,000,000 in compensation as well as $3,000,000 return for building the apartments. There is also a 10% chance of that the law suit lingers for a long time that any future return will be negated with additional $200,000 in costs. If you lose the law suit you then will have to either sell the property or build office buildings. However, if the law suit has gone this far, you feel that the selling price will be dependent on the town's growth prospect at the time, estimated as 50-50 chance. If the town grows the estimated sale price will be $900,000 whereas if the town does not grow then the estimated sale price will be $500,000. Finally, if you build the office building you think that the chance of town growth is 50%, in which case the return will be only $1.2million. If there is no growth the return is estimated as $100,000.

   a) Illustrate the above problem that you face, with whatever means you deem best. Please indicate all necessary information.

   b) What decision should be made and why?

2) The following is a student roster for my Management Science class.

Student	***GPA***	***Gender***	***International***	***Major***
1	3.04	M	Y	FIN
2	2.35	M	N	FIN/ACCT
3	2.26	M	Y	MGT
4	2.15	M	Y	MKGT
5	3.23	F	N	MGT
6	3.95	F	N	FIN
7	2.87	M	N	FIN
8	2.65	F	N	FIN
9	3.12	M	N	FIN
10	3.08	M	Y	MKGT
11	3.35	M	Y	MKGT
12	2.78	M	N	ACCT
13	2.56	F	Y	MKGT
14	2.91	F	N	ACCT
15	3.40	F	Y	MGT
16	3.12	M	Y	FIN
17	2.75	M	Y	ACCT
18	3.06	F	N	MGT

I want to create 6 group project teams of 3 students. I would like the teams to be relatively equal in terms of academic capability as well as maintaining some type of diversity among students. To be more specific, I want the teams to have a minimum average GPA of 2.80 while also striving to achieve the maximum overall average team GPA possible. I would also like that the team composition is diverse, so I don't want there to be more than two of the same major on any given team. In addition, I would like the team to have at least 1 female and 1 international student, but no more than 2 females or 2 international students on a given team. Help me create an optimization program which could achieve this goal.

3) You have $1000 to invest in speculative stocks A and B. You are considering investing X dollars in stock A and (1000-X) dollars in stock B. Investment in stock A has a 0.6 chance of doubling in value and 0.4 chance of being lost. Investment in stock B has a 0.7 chance of doubling and 0.3 chance of being lost. Your utility function for a change in wealth, Z, is $U(Z)=\log(0.0007*Z+1)$.

   a) What are the elements for Z? (hint: it consists of 4 elements)

   b) Find the optimal value of X in terms of expected utility.

4) In decision under ignorance, the maxmin, minimax and other decision criteria focus on the act's best and worst possible outcomes. What is so special about these **best** and **worst** outcome? Discuss

5) Your doctor suspects that you may have a rare disease that affects about 1 in 50,000. Given that you have the disease the test offered by the doctor will show positive with 0.9 probability. Unfortunately, the test will also show positive with probability 0.01 when applied to a healthy person. What is the probability that you have the disease given that the test is positive? What is your opinion about the test offered by the doctor?

6) Your prior probability that the coin is biased to land heads is 0. Prove that whatever happens in your experiment (or observations in tossing the coin), the posterior probability will always be zero. Discuss the implications.

7) Based on Spencer et al. (1990), when you lease 800 phone numbers from AT&T for telemarketing, AT&T uses an optimization model to tell you where you should locate calling centers to minimize your operating costs over a 10-year horizon. To illustrate the model, suppose you are considering seven calling center locations: Boston, NY, Charlotte, Dallas, Chicago, LA and Omaha. You know the average cost (in dollars) incurred if a telemarketing call is made from any of these cities to any region in the country. You also know the hourly wage that you must pay workers in each city. This information is given in table 1 (excel sheet: Q7_tables).

   Also, assume that an average call requires 4 minutes of labor. You make calls 250 days per year, and the average number of calls made per day to each region of the country is listed in table 3 (excel sheet: Q7_tables). Each calling center can make up to 5000 calls per day.

   Given this information how can you minimize the discounted cost (at a 10% per year) of running the telemarketing operation for 10 years? Assume that all wage and calling costs are paid at the ends of the respective years.

   Excel Note/Hint:

   Your objective function (total present value of costs) can be calculated as follows in excel:

   O.Function = Onetime Building Cost + PV(interest rate, planning horizon(10 years), -sum(annual wage cost, annual calling cost))

   PV is an Excel Function!!

For Binary decision variables utilize (bin) in excel solver