GSOE9210 Engineering Decisions

Problem Set 02

1. For the software project budgeting example in lectures, how would the decision be affected if the discount rate was 10%?

2. For the travelling problem in lectures, the values of outcomes based on walking distance (km) are given below:

	b_L	b_P
Tr	2	2
Bu	1	4

   (a) Describe each action as a lottery.
   (b) What is the *MaxiMax* (MM) action for this problem?
   (c) How would this be affected if the traveller had to visit the hospital's clinic, a further kilometre south of the hospital, afterwards?
   (d) Draw the decision table for the same problem using walking time instead, assuming a person walks at an average speed of 3km/h.
   (e) Which action is chosen under the *MaxiMax* rule when considering walking time?

3. Repeat the above exercise for the *Maximin* (Mm) rule.

4. Suppose Alice is the principal in the school fund-raising problem discussed in lectures:

	d	w
S	120	85
F	150	75

d	day is dry
w	day is wet

   (a) Represent each action as a lottery.
   (b) Which action is preferred under *MaxiMax* and *Maximin*?
   (c) What optimism level (*i.e.*, value of index α under *Hurwicz*'s rule) would Alice have if she were 'indifferent' between (*i.e.*, have equal preference for) the two options?
   (d) Derive a general expression for the value of the optimism index α^* for which Alice would be indifferent between actions A_1 and A_2, with best and worst outcomes M_1 and m_1, and M_2 and m_2, respectively.
   (e) Suppose there was a third option, an *indoor trivia night* (T), which generates profit \$100 regardless of the weather. How optimistic would Alice have to be to prefer the sports day over the trivia night?

5. How could you simplify Laplace's decision rule of insufficient reason? That is, can you give an equivalent, but simpler, criterion for choosing between actions?

6. Alice has a choice of buying an investment property in either of two suburbs: A and B. In five years, house prices are likely to go up by $\$2K$ in B, and by $\$1K$ in A. However, there is an existing proposal to build a shopping centre in A in the next year. If the shopping centre is approved (a), house prices in A will increase in value over the next five years by $\$6K$.

   For the problem described above:

   (a) Which is the *Maximin* action?
   (b) Which is the best action if approval from the shopping centre is granted? If approval is not granted?
   (c) Which is the *miniMax Regret* action?
   (d) Which of the two decision rules above would be most relevant for a property investor?

7. Consider the following decision table:

	s_1	s_2	s_3	s_4	V
A_1	2	2	0	1	
A_2	1	1	1	1	
A_3	0	4	0	0	
A_4	1	3	0	0	

   (a) Evaluate each action under the following decision rules, and determine which action will be chosen under each rule: i. *MaxiMax* (MM) ii. *Maximin* (Mm) iii. *Hurwicz*'s rule for values of $\alpha = 0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1$.
   (b) Which decision rules above *agree* on this problem; *i.e.*, choose the same actions?
   (c) Two decision rules are said to be *equivalent* if they choose the same action for every possible decision problem. Which of the rules above are equivalent?

8. For the problem above, which is the *miniMax Regret* action?

9. For the raffle problem discussed in lectures:

   (a) Draw the decision tree and table
   (b) Should you draw a ticket in the raffle?
   (c) What if you knew there were three blue tickets? Four? None?
   (d) How many blue tickets would there have to be to make it worth entering?
   (e) If there were n blue tickets ($0 \leqslant n \leqslant 4$), how would the the value of the prize which makes it worthwhile entering depend on n?