# Exercise 2

## #1 Utility assessment and expected utility

The year is 2030 and you are in the supercomputer business. Your firm currently produces a machine that is relatively expensive (list price $6 million) and relatively slow (for supercomputers in the 21$^{st}$ century). Speed of supercomputers is measured in gigaflops per second (gps), where one "flop" is one calculation. Thus, 1 gps = 1 billion calculations per second. Your current machine is capable of 150 gps. If you could do it, you would prefer to develop a supercomputer that costs less (to beat the competition) and is faster.

You have an R&D decision to make based on two alternatives. You should choose one or the other of the following projects as the budget constraints prevent you from engaging in both of them.

A. **The super-supercomputer:** This project involves the development of a machine that is extremely fast (800 gps) and relatively inexpensive ($5 million). But this is a fairly risky project. The engineers who have been involved in the early stages estimate that there is only a 50% chance that this project would succeed. If it fails, you will be stuck with your current machine.

B. **The better supercomputer:** This project would pursue the development of an $8 million machine capable of 500 gps. This project is also somewhat risky. The engineers believe that there is only a 40% chance that this project will achieve its goal. They quickly point out, however, that even if the $8 million, 500 gps machine does not materialize, the technology involved is such that they would at least be able to produce a $5 million machine capable of 350 gps.

a) Build a decision tree representing the situation.

To decide between the two alternatives, you have made the following assessments:

I. The best possible outcome is the $5 million, 800 gps machine, and the worst outcome is the status quo $6 million, 150 gps machine.

II. If you had the choice, you would be indifferent between alternatives X and Y shown in Figure 1 (a).

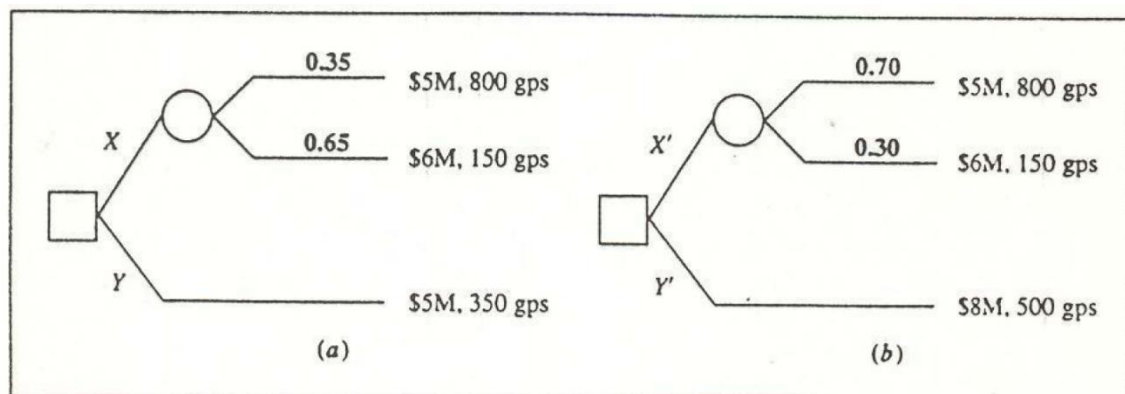III. If you had the choice, you would be indifferent between alternatives X' and Y' in Figure 1 (b).



**Figure 1**

b) Using assessments I, II and III, decide between projects A and B. Justify your decision.

c) Explain why project A appears to be riskier than project B. Given that A is riskier than B, would you change your answer to part a? Why or why not?

d) Suppose that you meet an experienced and insightful colleague who can predict with 100 % accuracy the success and failure of both projects under consideration. How much more utility can you expect to gain if you could make your selection between A and B only after discussing with this colleague?