

Midterm 3

1. (10 points) Choose one of the following as the best estimate of the costs of running a 6-person internet startup for one year (assume that the employees are paid regular salaries).

- a) \$50,000
- b) \$500,000
- c) \$5 million

Answer: b. Answer a would not even cover one employee's salary. While c would mean spending close to \$1m per employee. Web-startups don't have many costs beside salaries.

2. (5 points) The GDP is the value of all the goods and services produced in a country in a year. It is best described as

- a) a flow
- b) a stock

Answer: a. It is the value **per year**.

3. (10 points) Currently 16% of the US GDP is being spent on healthcare. The UK spends 8% of GDP. Choose one of the following as the best estimate of the annual savings per person if the US adopted the UK healthcare system.

- a) \$30
- b) \$300
- c) \$3000
- d) \$30,000

Answer: c. GDP is the value produced in a year. Thus it is similar to the money earned in a year. So it is about \$50,000 per person (times 300m to get the total GDP). Thus an 8% reduction is about 3000 per person. It is not d, \$30,000 because that is a lot of people's yearly income. Thus it is too big to be their yearly savings in healthcare costs. Similarly, the answer is not b, because most people spend a lot more than \$600/year on healthcare so a 50% reduction in health care costs will be a lot greater than \$300/year.

4. A government committee is considering the economic benefits of a program of preventative flu vaccinations. If vaccinations are not introduced then the estimated cost to the government if flu strikes in the next year is \$12.7m. It is estimated that such a program will cost \$7m and that the probability of flu striking in the next year is 0.75.

One alternative open to the committee is to institute an "early-warning" monitoring scheme (costing \$3m) which will enable it to detect an outbreak of flu early and hence institute a rush vaccination program (costing \$10m because of the need to vaccinate quickly before the outbreak spreads).

What recommendations should the committee make to the government if their objective is to maximise expected monetary value? (*Hint: there is no discounting in this problem.*)

4a. (15 points) Draw the decision tree. Don't forget to include the probabilities and label the outcome nodes with their present values.

4b. (15 points) Solve the decision tree.

Answer: Go to <http://people.brunel.ac.uk/~mastjjb/jeb/or/decmore.html> and scroll down to "Decision tree example 1986 UG exam". I've changed the currency from pounds to dollars. The exam problem also deals with only the average case of flu (the problem online had three scenarios of flu severity). However the numbers will be the same.

5. A company is trying to decide whether to bid for a certain contract or not. They estimate that merely preparing the bid will cost \$10,000. If their company bid then they estimate that there is a 50% chance that their bid will be put on the "short-list", otherwise their bid will be rejected. Once "short-listed" the company will have to supply further detailed information (entailing costs estimated at \$5,000). After this stage their bid will either be accepted or rejected. The company estimates that the labour and material costs associated with the contract are \$127,000. They are considering three possible bid prices, namely \$155,000, \$170,000 and \$190,000. They estimate that the probability of these bids being accepted (once they have been short-listed) is 0.90, 0.75 and 0.35 respectively.

What should the company do and what is the expected monetary value of your suggested course of action? (*Hint: there is no discounting in this problem.*)

5a. (15 points) Draw the decision tree. Don't forget to include the probabilities, to label any costs incurred on any edges, and to label the outcome nodes with their present values.

5b. (10 points) Solve the decision tree.

[Problems 4 & 5 are adapted from problems by J E Beasley.]

Answer: Go to <http://people.brunel.ac.uk/~mastjjb/jeb/or/decmore.html> and scroll down to "Decision tree example 1993 UG exam". I've changed the currency from pounds to dollars but otherwise kept it the same.

6. The president of a petroleum distribution company currently faces a serious problem. His company supplies refined products to its customers under long-term contracts at guaranteed prices. Recently, the price for petroleum has risen substantially and his company will lose \$450,000 this year because of its long-term contract with a particular customer. After a great deal of discussion with his legal advisers and his marketing staff, the president learns that the contract contains a clause that may be beneficial to his company. The clause states that when circumstances are beyond its control, the company

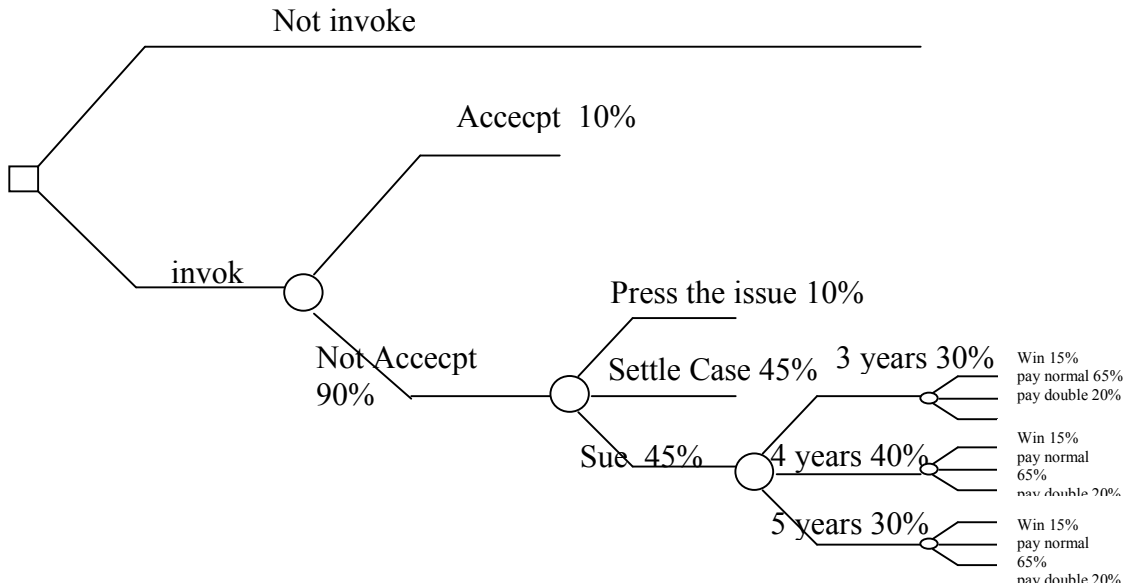
may ask its customers to pay the prevailing market prices for up to 10% of the promised amount.

Several scenarios are possible if the clause is invoked. With 10% probability the customer accepts the invocation of the clause and agrees to pay the higher price for the 10%, the company would turn a loss of \$450,000 into a net profit of \$600,000. If the customer does not accept the invocation of the clause, the distribution company could then sell the 10% on the open market. This would turn the loss of \$450,000 into an expected net profit of \$500,000. If the customer does not accept the invocation, they may simply decline to press the issue with a 10% probability (leaving you with the \$500,000 profit); they may go for a \$900,000 settlement with a 45% probability (leaving you with a net loss of $\$500k - 900k = \$400k$); or they may sue with a 45% probability. However, the lawsuit would result in one of three possible outcomes: the company wins and pays no damages with 15% probability; the company loses and pays normal damages of \$1,500,000 with 65% probability; or the company loses and pays double damages of \$3,000,000 with 20% probability. The lawyers also feel that this case might last three to five years if the customer decides to sue the company (with 30% probability for 3 years, 40% for 4 years, and 30% for 5 years). The cost of the legal proceedings is estimated as \$30,000 for the initial fee and \$20,000 per year. Suppose that the company decides to use a discount rate of 10% to determine the present value of future funds.

[Source: <http://www.uc.edu/sashtml/orpm/chap3/sect42.htm>]

- 6a.** (10 points) Draw the decision tree. Don't forget to include the probabilities.
- 6b.** (10 points) For each outcome node draw a cashflow diagram.
- 6c.** (10 points extra credit) Calculate the present values at the outcome nodes and solve the decision tree.

Answer:



This answer assumes that the \$600,000 of accepting the clause, the \$500,000 of not accepting the clause, and \$20,000 in initial legal fees are paid/received today. A perfectly acceptable alternative is to assume they are paid/received at the end of the first year.

$$PV[\text{Win}] = \$500,000$$

$$PV[\text{pay normal}] = \$500,000 - \$1,500,000 / (1+0.1)^n$$

$$PV[\text{pay double}] = \$500,000 - \$3,000,000 / (1+0.1)^n$$

$$\text{Let } X(n) = 0.15 * PV[\text{Win}] + 0.65 * PV[\text{pay normal}] + 0.2 * PV[\text{pay double}] = \$500,000 - \$1575000/(1+0.1)^n$$

$$PV[3 \text{ years}] = -\$30,000 - \$20,000 * 1 / 0.1 * (1 - 1/(1+0.1)^3) + X(3) = -\$763,058$$

$$PV[4 \text{ years}] = -\$30,000 - \$20,000 * 1 / 0.1 * (1 - 1/(1+0.1)^4) + X(4) = -\$669,144$$

$$PV[5 \text{ years}] = -\$30,000 - \$20,000 * 1 / 0.1 * (1 - 1/(1+0.1)^5) + X(5) = -\$583,767$$

$$PV[\text{SUE}] = (0.3 PV[3 \text{ years}] + 0.4 PV[3 \text{ years}] + 0.3 PV[3 \text{ years}]) = -\$671,705$$

$$PV[\text{Settle Case}] = -\$400,000$$

$$PV[\text{Press issue}] = \$500,000$$

$$PV[\text{Not accept}] = 0.1 * PV[\text{Press issue}] + 0.45 * PV[\text{Settle Case}] + 0.45 * PV[\text{SUE}] = -\$432,267$$

$$PV[\text{accept}] = \$600,000$$

$$PV[\text{invoke}] = 0.1 * PV[\text{accept}] + 0.9 * PV[\text{Not accept}] = -\$329,041 > -\$450,000$$

We should invoke.