

- 1.1 (L2.5) A major European lottery advertises that it pays the winner 10 million euros. However, this prize money is paid at the rate of 500 000 € each year (with the first payment being immediate) for a total of 20 payments. What is the present value of this prize at 10% interest?
- 1.2 (L2.6) A young couple has made a nonrefundable deposit of the first month's rent (equal to 700 €) on a 6-month apartment lease. The next day they find a different apartment they like just as well, but its monthly rent is only 600 €. Assume an interest rate of 12%.
- Should they switch to the new apartment, if they plan to be in the apartment only 6 months?
  - What if they plan to stay 1 year?
- 1.3 (L2.8) Two copy machines are available. Both have useful lives of 5 years. One machine can either be leased or purchased outright; the other must be purchased. Hence there are a total of three options: A (leasing machine 1), B (purchasing machine 1) and C (purchasing machine 2). The details are shown in Table 1. (The first year's maintenance is included in the initial cost. There are then four additional maintenance payments, occurring at the beginning of each year, followed by revenues from resale.) The present values of the expenses of these three options using a 10% interest rate are also indicated in the table. According to a present value analysis, the machine of least cost, as measured by the present value, should be selected; that is, option B.

It is not possible to compute the IRR for any of these alternatives, because all cash flows are not positive. However, it is possible to calculate the IRR on an incremental basis (that is, the IRR with which a change from an alternative to another has a zero present value). If this exceeds the prevailing interest rate, a change can be justified.

- Find the IRR corresponding to a change from A to B. Is a change from A to B justified on the basis of the IRR?
- What about a change from B to C?

Table 1: Copy Machine Options

	Alternative		
	A	B	C
Initial outlay	-6000	-30000	-35000
Yearly expense (paid at the start of the year)	-8000	-2000	-1600
Resale value (paid at the end of the year)	0	10000	12000
<b>Present value (@10%)</b>	<b>-39359</b>	<b>-32131</b>	<b>-34221</b>

- 1.4 (L2.13) In general, we say that two projects with cash flows  $x = (x_0, x_1, \dots, x_n)$  and  $y = (y_0, y_1, \dots, y_n)$  *cross*, if  $x_0 < y_0$  and  $\sum_{i=0}^n x_i > \sum_{i=0}^n y_i$ . Let  $P_x(d)$  and  $P_y(d)$  denote the present values of these two projects as a function of the discount factor  $d = 1/(1+r)$ .
- Show that there is a crossover value  $c > 0$  such that  $P_x(c) = P_y(c)$ .
  - For cash flows in Table 2, calculate the crossover value  $c$ .

Table 2: Cash flows of projects 1 and 2

	Year					
	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Project 1	-100	30	30	30	30	30
Project 2	-150	42	42	42	42	42

- 1.5 (L2.15) A division of ABBOX Corporation has developed the concept of a new product. Production of the product would require initial capital expenditure of 10 million euros. It is anticipated that 1 million units would be sold each year for 5 years, and then the product would be obsolete and production would cease. Each year's production would require 10,000 hours of labour and 100 tons of raw material. Currently (year 0) the average wage rate is 30€ per hour and the cost of the raw material is 100€ per ton. The product would sell for 3.30€ per unit, and this price is expected to be maintained (in real terms). ABBOX management likes to use a 12% discount rate for projects of this type and faces a 34% tax rate on profit. The initial capital expenditure can be depreciated in a straight-line fashion over 5 years. (Depreciation reduces the taxable profit, but is not otherwise included in the investment calculation.)
- In its first analysis of this project, management did not apply inflation factors to the extrapolated revenues and operating costs. What present value did they obtain?
  - How would the answer change if an inflation rate of 4% was applied? Inflation increases wage rate, raw material costs and the price of the product.