ENSC 201 Mid-Term 2

October 18, 2013

This is the second part of a closed-book quiz. Calculators may be used. A crib sheet and tables of interest rates are provided.

**Section I (Long Answer)**

**Name:** **Number:**

1. Squamish Helitours maintains a fleet of ten identical helicopters, each an AugustaWestland Koala. Their business plan is to buy a new Koala when it is economical to do so, and to re-sell an older one at the same time. The cost of a new Koala is $3,000,000, and its resale value drops by 25% a year, so after a year its market price is about $2,250,000, after two years it’s $1,687,500, and so on. The maintenance costs are expected to be $150,000 in the first year, and to go up by an additional $200,000 in every subsequent year. You can assume that maintenance charges are paid at the end of the year in which they occur.

The company’s cost of capital is 10%. How long should they keep each helicopter before selling it? (30 points)

*This calls for the calculation of the* economic life *of the Koala, for which you need to construct a bathtub curve.*

*The two components of the bathtub curve are the capital recovery, and the annual average equivalent of the summed maintenance costs.*

*The capital recovery is given by*

*ACR = (P – S)(A/P,i,N) + Si (this is in the formula sheet)*

*But it can also be calculated from*

*ACR = P(A/P,i,N) – S(A/F,i,N) (which gives the same result)*

*Or from*

*ACR =( P – S(P/F,i,N))(A/P,i,N) (which also gives the same result)*

*The annual average equivalent of the maintenance cost is*

*AMC  = (Sum over n =1 to N of M(n)(P/F,i,n))(A/P,i,N) where M(n) is the maintenance cost in year n*

*Then EUAC = ACR +AMC*

*If you’ve written down these expressions, or something equivalent, you get 23 points. Then you get a further 5 points for calculating the values of EUAC correctly, and a further 2 points for saying how long you should keep the Koala.*

*It turns out that the EUAC is a minimum after three years, so Squamish Helitours should keep each of their Koalas three years before selling it.*

*It is* ***not*** *the case that the helicopter should be sold once the maintenance cost exceeds the salvage cost. Nor is it the case that it should be sold once the ACR is equal to the AMC.*

*Here are the actual numbers.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **N** | **Salvage Value** | **ACR** | **Maintenance** | **PW(Maint)** | **Sig(PW(M))** | **EUAC** |
| 1.0000 | $2,250,000 | $1,050,000 | $150,000 | $136,364 | $136,364 | $1,200,000 |
| 2.0000 | $1,687,500 | $925,000 | $350,000 | $289,256 | $425,620 | $1,170,238 |
| 3.0000 | $1,265,625 | $823,980 | $550,000 | $413,223 | $838,843 | $1,161,292 |
| 4.0000 | $949,219 | $741,883 | $750,000 | $512,260 | $1,351,103 | $1,168,117 |
| 5.0000 | $711,914 | $674,783 | $950,000 | $589,875 | $1,940,978 | $1,186,808 |
| 6.0000 | $533,936 | $619,620 | $1,150,000 | $649,145 | $2,590,123 | $1,214,332 |
| 7.0000 | $400,452 | $574,007 | $1,350,000 | $692,763 | $3,282,887 | $1,248,330 |
| 8.0000 | $300,339 | $536,069 | $1,550,000 | $723,086 | $4,005,973 | $1,286,965 |
| 9.0000 | $225,254 | $504,334 | $1,750,000 | $742,171 | $4,748,144 | $1,328,804 |
| 10.0000 | $168,941 | $477,636 | $1,950,000 | $751,809 | $5,499,953 | $1,372,728 |

**Section II (Multiple Choice)**

1. In this course [ENSC 201], we have studied a number of methods for comparing the profitability of different projects. When we use the following four criteria to compare a set of different projects, which may involve initial investments of different sizes, all but one will always identify the same project as the best choice. Which criterion is the odd one out?
	* 1. Biggest Present-worth
		2. Incremental rate-of-return
		3. Biggest Equivalent Uniform Annual Worth
		4. *Shortest payback period*
2. If the nominal interest rate offered by a bank is 15% per year, compounded monthly, then the *effective* annual interest rate is:
	* 1. *(1+0.15/12)12 - 1*
		2. (1+0.12/15)15 - 1
		3. (1+0.12/15)12 - 1
		4. (1-0.15)12 + 1
3. I am considering two mutually exclusive projects, X and Y. Y involves a larger initial investment. The only condition which is both necessary and sufficient for choosing X is:
	* 1. The IRR for X is greater than my MARR
		2. *The IRR for X is greater than my MARR and the incremental IRR for cancelling X in favour of Y is less than my MARR*
		3. The IRR for X is greater than my MARR *and* the IRR for Y is less than my MARR
		4. The IRR for X is greater than my MARR *and* the incremental IRR for cancelling X in favour of Y is greater than my MARR
4. A bank advertises that it offers an interest rate of 2.343% per month, compounded every two years. What effective annual interest rate is this equivalent to?
	* 1. 12%
		2. 20%
		3. *25%*
		4. 30%
5. We are promised a series of annual payments of $A to us, starting in a year’s time and going on forever. The present worth of this infinite series of payments will be a finite number:
	* 1. Unless the interest rate is infinite
		2. Unless the interest rate is zero
		3. Only if the interest rate is infinite
		4. Only if the interest rate is zero
6. Our MARR is *i*%. We want to set aside an arithmetically increasing amount $G every year to pay for the purchase, in N years, of a machine that will cost $F. The size of G can be calculated from the formula:
	* 1. F(F/A,i,N)(G/A,i,N)
		2. *F(A/F,i,N)(G/A,i,N)*
		3. F(P/F,i,N) (A/G,i,N)
		4. F(A/F,i,N) (A/G,i,N)
7. A project involves an initial outlay of $500, and yields a return of $1037 after four years. What is the highest value of MARR at which this project would be a worthwhile investment?
	* 1. 10%
		2. 11%
		3. *20%*
		4. 21%
8. You have $500 to invest, and have two opportunities available. The first is to put $250 into Project A; this will yield $275 after a year. The second is to put $400 into Project B; this will yield $480 after a year. You can also put money into the bank, where it will earn 15% interest, or borrow money from the bank at 18% interest. What is your most profitable strategy?
	* 1. Put $250 in Project A and the rest in the bank
		2. *Put $400 in Project B and the rest in the bank*
		3. Put all $500 in the bank.
		4. Borrow $150 from the bank and do both A and B
9. I have an asset costing $55,000 which I can depreciate either by straight-line depreciation (SLD) or by Sum-of-years-digits depreciation (SOYD). In each case, it will depreciate to zero over ten years. The annual amount by which it depreciates using the SLD method will first exceed the amount by which it would depreciate using the SOYD method in the:
	* 1. Second year
		2. Third year
		3. Fifth year
		4. *Sixth Year*
10. You have been promised a series of eight annual payments of $500, the first payment arriving eight years from now. Your personal MARR is 10%. The present worth of this series of payments is:
	* 1. $500(P/F, 0.1, 6)(P/A, 0.1,8)
		2. *$500(P/F,* 0.1*, 7)(P/A,* 0.1*, 8)*
		3. $500(F/P, 0.1, 8)(A/P, 0.1,8)
		4. $500(F/P, 0.1, 9)(P/A, 0.1,8)