ISE 307, Term 153

ENGINEERING ECONOMIC ANALYSIS

HW# 2 Solution

Due date: Monday, July 25

Q.1. A California bank, Berkeley Savings and Loan, advertised the following information: 10% interest and effective annual yield 10.38%. No mention is made of the interest period in the advertisement. Can you figure out the compounding scheme used by the bank?

$0.1038 = (1 + 0.10/m)^m -1 \Rightarrow$ m=4 i.e., compounded quarterly

Q.2. You obtained a loan of $20,000 to finance your home improvement project. Based on monthly compounding over 24 months, the end-of-the-month equal payment was figured to be $1000. What is the APR used for this loan?

$20000 = 1000$ (P/A, i, 24)

$[(1+i)^{24} – 1]/[i (1+i)^{24}] = 20 \Rightarrow$ i=1.5138%

Thus, APR $= 1.5138\% * 12 = 18.157\%$

Q.3. Bank A charges 10% compounded monthly on its business loan. Bank B charges 9.96% compounded daily. If you want to borrow money, which bank would you choose?

Effective interest rate for Bank A $= (1+0.10/12)^{12} -1 = 10.47131\%$

Effective interest rate for Bank B $= (1+0.0996/365)^{365} -1 = 10.47139\%$

Both banks have very close interest rate but Bank A is very negligibly better.

Q.4. A man is planning to retire in 20 years. He wishes to deposit a regular amount every two months until he retires so that, beginning one year following his retirement, he will receive annual payments of $30,000 for the next 10 years. How much must he deposit if the interest rate is 10% compounded monthly?

$I_{2m} = (1+0.10/12)^2 – 1 = 0.01674$

$F_{20} = A$ (F/A, 0.01674, 120) $= A [(1.01674)^{120} - 1]/0.01674 = 378.11A$

$I_y = (1+0.10/12)^{12} = 0.1047$

$P_{20} = 30000 [(1.1047)^{10} - 1]/[0.1047*(1.1047)^{10}] = \$180,663$

$F_{20} = P_{20} \Rightarrow 378.11A = 180663 \Rightarrow A = \$477.81$

Q.5. You are in financial trouble and are delinquent on your mortgage payment. Your bank has agreed to a repayment schedule of $1,000 per month, and it will charge 6% interest on the outstanding balance. If the current outstanding balance is $15,000, how long will it take for you to pay off the loan?

$i_m = 0.06/12 = 0.005$

$15000 = 1000$ (P/A, 0.005, N)

$15000 = 1000 [(1.005)^N - 1]/[0.005*(1.005)^N] \Rightarrow N = 15.63$ months

Q.6. If the interest rate is 10% compounded continuously, what is the required quarterly payment to repay a loan of $20,000 in five years.

$i_q = e^{0.10/4} - 1 = 0.0253$

$20000 = A$ (P/A, 0.0253, 20)

$20000 = A [(1.0253)^{20} - 1]/[0.0253*(1.0253)^{20}]$

$20000 = A$ 15.5429 $\Rightarrow A = \$1,286.765$

Q.7. Ali borrowed $50,000 from a bank at an interest rate of 10% compounded monthly. This loan is to be repaid in 48 equal monthly installments over four years. Immediately after his 20th payment, Ali desires to pay the remainder of the loan in a single payment. Compute the total amount he must pay at that time.

$i_m = 0.10/12 = 0.0083$

$50000 = A$ (P/A, 0.0083, 48) $= A$ 39.4282

$A = 50000/39.4282 = 1268.129$

$P_{20} = 1268.129$ (P/A, 0.0083, 28) $= \$31,552.74$

Q.8. You want to open a savings plan for your future retirement. You are considering the following two options:

Option 1: You deposit $1,000 at the end of each quarter for the first 10 years. At the end of 10 years, you make no further deposits, but you leave the amount accumulated at the end of 10 years for the next 15 years.

Option 2: You do nothing for the first 10 years. Then you deposit $5,000 at the end of each year for the next 15 years.

If your deposits or investments earn an interest rate of 10% compounded quarterly, which option will save you more money at the end of 25 years from now, and by how much.

Option 1:

$i_q = 0.1/4 = 0.025$

$F_{10} = 1000$ (F/A, 0.025, 40) $= 1000*67.4026 = \$67,402.55$

$F_{25} = 67402.55$ (F/P, 0.025, 60) $= 67402.55 * 4.3998 = \$296,557.06$

Option 2:

$i_y = (1+0.1/4)^4 - 1 = 0.1038$

$F_{25} = 5000$ (F/A, 0.1038, 15) $= 5000*32.7492 = \$163,746$

Option1 will save more money than option 1 by $296557.06 - 163746.03 = \$132,811.03$

Q.9. A restaurant is considering purchasing the lot adjacent to its business to provide adequate parking space for its customers. The restaurant needs to borrow $100,000 to secure the lot. A deal has been made between a local bank and the restaurant such that the restaurant would pay the loan back over a five-year period with the following payment terms: 10%, 20%, 30%, 40%, and 50% of the initial loan at the end of the first, second, third, fourth, and fifth years, respectively.

(a) What rate of interest is the bank earning from this loan transaction?

   $100000 = 10000$ (P/A, i, 5) $+ 10000$ (P/G, i, 5)

   $\Rightarrow$ $i = 12.0058\%$

(b) What would be the total interest paid by the restaurant over the five-year period?

   Money paid $= 10000 + 20000 + 30000 + 40000 + 50000 = \$150,000$
   Interest $= 150000 - 100000 = \$50,000$