1. (10p) Two banks offer different interest rates on your deposit of $10,000 over 3 years. Bank A offers an 8% interest compounded annually and Bank B offers an 8.5% simple annual interest. Which bank do you prefer?

2. (10p) If you invest $2,000 today in a savings account at an interest rate of 12%, compounded annually, how much principal and interest would you accumulate in 7 years?

3. (10p) You are planning to borrow $100,000 on a 10-year, 6%, with 10 annual payments. What fraction of the payment made at the end of the second year will represent repayment of principal?

4. (20 p) If you make the following series of deposits at an interest rate of 10%, compounded annually, what would be the total balance at the end of 10 years?

<table>
<thead>
<tr>
<th>End of Period</th>
<th>Amount of Deposit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$800</td>
</tr>
<tr>
<td>1–9</td>
<td>$1500</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

5. (10p) How many years will it take for an investment to double itself if the interest rate is 9%, compounded quarterly?

6. (15p) You are considering purchasing a piece of industrial equipment that costs $30,000. You decide to make a down payment in the amount of $5,000 and to borrow the remainder from a local bank at an interest rate of 9%, compounded monthly. The loan is to be paid off in 36 monthly installments. What is the amount of the monthly payment?

7. (10p) An investment project costs $90,000. It is expected to have an annual net cash flow of $30,000 for 5 years. What is the project's payback period?

8. (15p) What is the capitalized equivalent amount, at 10% annual interest, for a series of annual receipts of $400 for the first 10 years, which will increase to $500 per year after 10 years, and which will remain constant thereafter?
1. Given: $P=10000, N=3\text{ years, } i_A=8\%; \ i_B=8.5\% \text{ (simple annual interest)}$
Find: $F_A$ and $F_B$ to decide which Bank (A or B) you prefer.

$$ F_A = P(1 + i_A)^N = 10000(1 + 0.08)^3 = 12597.12 $$

$$ F_B = P\left[1 + (i_B)(N)\right] = 10000(1 + (0.085)(3)) = 12550 $$

Difference = $F_A - F_B = 12597.22 - 12550 = 47.22$

you earn $47.22 more with Bank A than with Bank B. Choose Bank A.

2. Given: $P=2000, N=7\text{ years, } i=r=12\%$
Find: $F$

$$ F = P(1 + i)^N = 2000(1 + 0.12)^7 = 4421.36 $$

3. Given: $P=100000, i=6\%, N=10\text{ years}$
Find: $A$ (annuity) and portion of the principal payment in the 2\text{nd} year

$$ A = 100000(A/P, 6\%, 10) = 100000(0.1359) = 13590(\text{Factor : Table / p.881}) $$

\text{First Year:}

$$ I_1 = 100000(0.06) = 6000 $$

$$ P_1 = A - I_1 = 13590 - 6000 = 7590 $$

$$ B_1 = 100000 - 7590 = 92410 $$

\text{Second Year:}

$$ I_2 = 92410(0.06) = 5544.60 $$

$$ P_2 = A - I_2 = 13590 - 5544.60 = 8045.40 $$

$$ B_2 = 92410 - 8045.40 = 84364.60 $$

\text{Fraction of the payment:}

$$ 8045.40 \over 13590 = 59.20\% $$

4. Given: $A_0=800, A=1500, i=10\%, N=10\text{ years}$
Find: $F$

Note that there are two cash flow components in the series. The first one is a single payment amount ($800) at the period 0 and the other is the $1500 equal payment series. Also we are looking for an equivalent value of these payments at the end of year 10, not year 9. Therefore, we may solve the problem in two steps. First find the equivalent future worth of the single payment at the period of 10. Then find the equivalent future worth amount of the $1500 payment series at the end of year 10.

\text{Single-payment:}

$$ V_1 = 800(F/P, 10\%, 10) = 800(2.5937) = 2074.96(Factor : Table / p.885) $$

\text{Equal-payment series: First find the equivalent future worth of the series at the end of year 9 and multiply this amount by (1.1) i.e. (F/P, 10\%, 1) to obtain the value at year 10.}

$$ V_2 = 1500(F/A, 10\%, 9)(F/P, 10\%, 1) = 1500(13.5795)(1.1000) = 22406.18 $$

\text{Total:}

$$ F = V_1 + V_2 = 2074.96 + 22406.18 = 24481.14 $$

5. Given: $F = 2P$ and $r = 9\% \text{ compounded quarterly}$
Find: $N$

$$ i_a = \left(1 + \frac{r}{M}\right)^M - 1 = \left(1 + \frac{0.09}{4}\right)^4 - 1 = 0.093083(9.3083\%) \text{ effective annual interest rate} $$
\[ (F / P, 9.3083\%, N) = (1 + 0.093083)^N = 2 \]
\[ N \log(1.093083) = \log 2 \to N = 7.79 \approx 8 \text{ years} \]

6. Given: \( P = $25000 \) (subtracted down payment of $5000 from the purchase cost),
\[ r = 9\% \text{ compounded monthly, and } N=36 \text{ months} \]

Find: \( A \)

\[ i = \frac{r}{M} = \frac{0.09}{12} = 0.0075(0.75\%) \text{ per month} \]

\[ A = $25000 \left( \frac{A}{P, 0.75\%, 36} \right) = $25000(0.0318) = $795 \text{ per month (factor taken from Table/p.872)} \]

7. Given: investment and cash flows, \( N=5 \) years

Find: conventional payback period

\[ \text{Payback period} = \frac{$90000}{$30000} = 3 \text{ years} \]

8. Given: cash flow series in perpetuity, MARR=10%

Find: capitalized equivalent worth

Approach: The original cash flow series can be divided into two series: the first one is the $400 series in perpetuity and the second one is the $100 series in perpetuity starting after 10 years.

\[ CE(10\%) = \frac{$400}{0.10} + \frac{$100}{0.10} \left( \frac{P}{F, 10\%, 10} \right) = $4000 + $1000(0.3855) = $4385.50 \]

Present Worth Factor was taken from Table/p.885