1. (35 p) Suppose you deposit $1,000 at the end of each quarter for 5 years at an interest rate of 10% compounded monthly. What equal end-of-year deposit over 5 years would accumulate the same amount at the end of 5 years under the same interest compounding (10%, compounded monthly)?

2. (30 p) For the monthly cash flow transactions shown below, determine the amount of money in the account at the end of first year if the rate is 6% compounded semiannually. Assume that deposits and withdrawal cash flows start to earn/charge interest immediately.

<table>
<thead>
<tr>
<th>End of Month</th>
<th>Amount of Deposit, $/Month</th>
<th>Amount of Withdrawal, $/Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>800</td>
<td>1500</td>
</tr>
<tr>
<td>6-11</td>
<td>1500</td>
<td>2600</td>
</tr>
<tr>
<td>12</td>
<td>500</td>
<td>1000</td>
</tr>
</tbody>
</table>

3. (35 p) You purchased computer equipment for $25,000 to use in your own business. You are able to make a $5000 down payment. The balance, $20,000 will be borrowed from your bank at an interest rate of 8% compounded weekly. The loan should be paid in 24 equal monthly payments.
   a) What will be your monthly payment?
   b) Consider the 12th payment. How much will the interest and principal payments be?
1. Given: deposit frequency = $1000 per quarter
   \[ r = 10\% \text{ compounded monthly} \]
   \[ N = 20 \text{ quarters} \]

   Find: Equivalent annual deposit amount \( (A) \)

   \( i_p \) should be determined according to the payment period \( (K=4) \) of the first cash flow by considering

   compounding monthly \( (C = \frac{M}{K} = \frac{12}{4} = 3) \) with the following equation:

   \[
   i_p = \left(1 + \frac{r}{M}\right)^C - 1 = \left(1 + \frac{0.10}{12}\right)^3 - 1 = 0.02521(2.52\%) 
   \]

   Second cash flow is based on equal end-of-year deposit over 5 years \( (K=1, C = M = 12) \) with the same interest compounding. \( i_a \) effective annual interest should be determined as follows:

   \[
   i_a = \left(1 + i_p\right)^K - 1 = \left(1 + \frac{r}{M}\right)^M - 1 = \left(1 + \frac{0.10}{12}\right)^{12} - 1 = 0.1047(10.47\%) 
   \]

   \( A \) can be calculated by equating the present worth of the first cash flow to the present worth of the second cash flow:

   \[
   \$1000\left(P/A, 2.52\%, 20\right) = A\left(P/A, 10.47\%, 5\right) 
   \]

   From Table 3.4 (Textbook/Park 4th ed.):

   \[
   \$1000\left[\frac{(1+0.0252)^{20} - 1}{0.0252(1+0.0252)^{20}}\right] = A\left[\frac{(1+0.1047)^5 - 1}{0.1047(1+0.1047)^5}\right] 
   \]

   \( A = \$4154.02 \)

2. Given: monthly cash flow on the table, \( r = 6\% \text{ compounded semiannually} \) \( (K=12, M=2, C=M/K=2/12=1/6=0.1667), N=12 \text{ months (period)} \)

   Find: \( F \)

   **Convention in terms of the account: Deposits (+), Withdrawals(-)**

   First effective interest rate per payment (month) period \( (i_p) \) should be determined from the following equation:

   \[
   i_p = \left[1 + \frac{r}{CK}\right]^C - 1 = \left[1 + \frac{0.06}{2}\right]^{1/6} - 1 = 0.004939(0.49\%) 
   \]

   Note that there are monthly cash flows (as deposits and withdrawals) given in the table. As for deposits, the first one is the +$1000 equal (uniform) deposit series (Period:1-4). The second one is a single deposit amount of +$800 (Period:5). The third one is the +$1500 equal (uniform) deposit series (Period:6-11). The fourth one is a single deposit amount (+$500) at the end of period 12. As for withdrawals, the first one is a single withdrawal amount (-$1500) at the period 5 (5th Month). The second one is the -$2600 equal (uniform) withdrawal series (Period:6-11). The third one is a single withdrawal amount (-$1000) at the end of period 12. We are looking for an equivalent value of these deposits and withdrawals at the end of year 1 (end of period 12).
\[ F = \$1000\left( \frac{F}{A,0.49\%,4} \right) + \$800\left( \frac{F}{A,0.49\%,7} \right) + \$1500\left( \frac{F}{A,0.49\%,6} \right) + \$500\left( \frac{F}{A,0.49\%,1} \right) - \$1000 \]

\[ F = \$1000\left[ \frac{(1 + 0.0049)^4 - 1}{0.0049} \right](1 + 0.0049)^8 + \$800\left[ (1 + 0.0049)^7 - 1 \right] + \$1500\left[ \frac{(1 + 0.0049)^6 - 1}{0.0049} \right](1 + 0.0049) + \$500\left[ \frac{(1 + 0.0049)^5 - 1}{0.0049} \right](1 + 0.0049) - \$1000 \]

\[ F = -\$3748.30 \]

(Formula : Table3.4)

3. a)  
Given:
\[ P = \$25000 - \$5000 = \$20000; \ r = 8\%; \ C = 4, \ M = 52, \ K = 12 \]
\[ N = 24 \]
Find : \( A \)
\[ i_p = \left( 1 + \frac{r}{M} \right)^C - 1 = \left( 1 + \frac{0.08}{52} \right)^4 - 1 = 0.00617 \text{(effective interest rate per month)} \]
\[ A = P\left( \frac{A}{i_p}, N \right) = \$20000\left( \frac{A}{i_p},0.62\%,24 \right) = \$20000\left[ \frac{0.0062\left( 1 + 0.0062 \right)^{24}}{\left( 1 + 0.0062 \right)^{24} - 1} \right]; \text{FormulaTable3.4} \]
\[ A = \$899.45 \]

b) For the period 12 (n=12); Principal payment \( (P_n) \) and interest payment \( (I_n) \) will be calculated based on the ending balance of the previous period \( (B_{n-1}) \) as follows:
\[ B_{11} = A\left( \frac{P}{A},0.62\%,24 - 11 \right) = A\left( \frac{P}{A},0.62\%,13 \right) = (\$899.45)\left[ \frac{(1 + 0.0062)^{13} - 1}{0.0062\left( 1 + 0.0062 \right)^{13}} \right] = \$11200.73 \]
\[ B_n = A\left( \frac{P}{A},0.62\%,N - n \right) I_n = (B_{n-1})i_p; \ P_n = A - I_n \]
P/A factor taken from Formula Table 3.4
\[ I_{12} = B_{11}i_p = (\$11200.73)(0.0062) = \$69.45 \]
\[ P_{12} = A - I_{12} = \$899.45 - \$69.45 = \$830.00 \]