1. (35 p) Suppose you deposit $1,000 at the end of each quarter for 5 years at an interest rate of 15% compounded daily. 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 (15%, compounded daily)?

2. (30 p) For the weekly cash flow transactions shown below, determine the amount of money in the account at the end of first year if the rate is 10% compounded quarterly. Assume that deposits and withdrawal cash flows start to earn/charge interest immediately.

<table>
<thead>
<tr>
<th>End of Week</th>
<th>Amount of Deposit, $/Week</th>
<th>Amount of Withdrawal, $/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>1500</td>
<td>500</td>
</tr>
<tr>
<td>21-40</td>
<td>2000</td>
<td>1000</td>
</tr>
<tr>
<td>41-52</td>
<td>2500</td>
<td>1500</td>
</tr>
</tbody>
</table>

3. (35 p) You purchased a machine for $300,000 to use in your own business. You are able to make a $30,000 down payment. The balance, $270,000 will be borrowed from your bank at an interest rate of 10% compounded quarterly. The loan should be paid in 16 equal quarterly payments.
   a) What will be your quarterly payment?
   b) Consider the 12th quarter (end of third year) payment. How much will the interest and principal payments be?
1. Given: deposit frequency=$1000 per quarter
   \[ r = 15\% \text{ compounded daily} \]
   \[ N = 20 \text{ quarters} \]
   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 daily \( (C = \frac{M}{K} = \frac{360}{4} = 90) \) with the following equation:

   \[
   i_p = \left(1 + \frac{r}{M}\right)^C - 1 = \left(1 + \frac{0.15}{360}\right)^{90} - 1 = 0.03820(3.82\%)\]

   Second cash flow is based on equal end-of-year deposit over 5 years \( K=1, \ C = M = 360 \) with the
   same interest compounding. \( i_a \) effective annual interest should be determined as follows:

   \[
   i_a = \left(1 + i_p\right)^K - 1 = \left(1 + \frac{r}{M}\right)^M - 1 = \left(1 + \frac{0.15}{360}\right)^{360} - 1 = 0.1618(16.18%)\]

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

   \[
   \$1000(P/A, 3.82\%, 20) = A(P/A, 16.18\%, 5)\]

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

   \[
   \$1000 \left[ \frac{(1 + 0.0382)^{20} - 1}{0.0382}\right] = A \left[ \frac{(1 + 0.1618)^5 - 1}{0.1618(1 + 0.1618)^5}\right]\]

   \( A = \$4235.28 \)

2. Given: weekly cash flow on the table, \( r = 10\% \text{ compounded quarterly} \) \( K=52, \ M=4, \ C=M/K=4/52=1/13=0.07692), \ N=52 \text{ quarter(period)} \)
   Find: \( F \)

   \textit{Convention in terms of the account: Deposits (+), Withdrawals(-) }

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

   \[
   i_p = \left[1 + \frac{r}{CK}\right]^C - 1 = \left[1 + \frac{0.10}{4}\right]^{1/13} - 1 = 0.001901(0.19\%)\]

   Note that there are quarterly cash flows (as deposits and withdrawals) given in the table. As for
   deposits, the first one is the +$1000 equal (uniform) deposit series (Period:1-10). The second one is
   the uniform deposit series of +$1500 (Period:11-20). The third one is the +$2000 equal (uniform) deposit series (Period:21-40). The fourth one is the uniform deposit series of +$2500 (Period:41-52).
   As for withdrawals, the first one is the uniform withdrawal series of -$500 (Period:11-20). The second one is the -$1000 equal (uniform) withdrawal series (Period:21-40). The third one is the
   uniform withdrawal series of -$1500 (Period:41-52). We are looking for an equivalent value of
   these deposits and withdrawals at the end of year 1 (end of period 52).
\[ F = \$1000 \left(\frac{F}{A,0.19\%,10}(F/P,0.19\%,42) + \$\left(1500 - 500\right)(F/A,0.19\%,10)(F/P,0.19\%,32) + \$\left(2000 - 1000\right)(F/A,0.19\%,20)(F/P,0.19\%,12) + \$\left(2500 - 1500\right)(F/A,0.19\%,12)\right) \]

\[ F = \$1000 \left[\left(\frac{1 + 0.0019}{0.0019}\right)^{10} - 1\right] \left(1 + 0.0019\right)^{42} + \$1000 \left[\left(\frac{1 + 0.0019}{0.0019}\right)^{20} - 1\right] \left(1 + 0.0019\right)^{12} + \$1000 \left[\left(\frac{1 + 0.0019}{0.0019}\right)^{10} - 1\right] \left(1 + 0.0019\right)^{32} + \]

\[ F = \$54601.07 \]

(\textit{Formula : Table3.4})

3. a) 
\textbf{Given:}
\[ P = \$300000 - \$30000 = \$270000; r = 10\%; C = 1, M = 4, K = 4 \]
\[ N = 16 \]
\textbf{Find:} \( A_Q \)
\[ i_p = i_e = \left(1 + \frac{r}{M}\right)^{-1} = \left(1 + \frac{0.10}{4}\right)^{-1} = 0.025(2.50\%, \text{effective interest rate per quarter}) \]
\[ A_Q = P \left(\frac{A}{P,i_e,N}\right) = \$270000 \left(\frac{A}{P,2.50\%,16}\right) = \$270000 \left[\frac{0.025(1 + 0.025)^{16}}{(1 + 0.025)^{16} - 1}\right]; \textit{Formula Table3.4} \]
\[ A_Q = \$20681.73 \]

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:
\[ B_{11} = A \left(\frac{P}{A,2.50\%,16 - 11}\right) = A \left(\frac{P}{A,2.50\%,5}\right) = \$20681.73 \left[\frac{(1 + 0.025)^5 - 1}{0.025(1 + 0.025)^5}\right] = \$96083.77 \]
\[ B_n = A \left(\frac{P}{A,0.62\%,N - n}\right) I_n = (B_{n-1}) \times P_n = A - I_n \]
P/A factor taken from Formula Table 3.4
\[ I_{12} = B_{11} i_i = (\$96083.77)(0.025) = \$2402.09 \]
\[ P_{12} = A_Q - I_{12} = \$20681.73 - \$2402.09 = \$18279.64 \]