1. (35 p) What value of $A$ makes the two annual cash flows equivalent at 9% interest compounded weekly?

2. (35 p) The machines shown below are under consideration for an improvement to an automated candy bar wrapping process. Determine which should be selected on the basis of their capitalized equivalents (CE) using an interest rate of 15% (MARR) compounded semiannually.

<table>
<thead>
<tr>
<th>Machine C</th>
<th>Machine D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cost, $</td>
<td>40000</td>
</tr>
<tr>
<td>Quarterly cost, $</td>
<td>2500</td>
</tr>
<tr>
<td>Salvage value, $</td>
<td>12000</td>
</tr>
<tr>
<td>Life, years</td>
<td>4</td>
</tr>
</tbody>
</table>

3. (30 p) A company purchased new packaging equipment with an estimated useful life of six years. The cost of the equipment was $75,000. The company does not expect the equipment to have a positive salvage or trade-in value after the anticipated 6-year life. For book depreciation purposes, company wants depreciation cost ($D$) and book value ($B$) schedules for the following methods:

a) Straight-line depreciation method (SL),
b) 125% Declining-Balance (DB) method,
c) Double Declining-Balance (DDB) method

<table>
<thead>
<tr>
<th>Periods</th>
<th>SL</th>
<th>125%DB</th>
<th>DDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_n$ ($)</td>
<td>$B_n$ ($)</td>
<td>$D_n$ ($)</td>
<td>$B_n$ ($)</td>
</tr>
<tr>
<td>0</td>
<td>75 000</td>
<td>75 000</td>
<td>75 000</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
1. Given: \( r = 9\% \) compounded weekly, \( K = 1 \)

Find: Equivalent annual deposit amount (\( A \)) of the second cash flow for the same \( F \) or \( P \) value with the 1st cash flow.

**First cash flow:**

\[ i_p \text{ should be determined according to the payment period of the first cash flow by considering compounding weekly:} \]

\[
K = 1, M = 52 \\
C = \frac{M}{K} = \frac{52}{1} = 52 \\
i_c = \frac{r}{M} = \frac{0.09}{52} = 0.00173 \\
i_p = i_u = (1 + i_c)^C - 1 = (1 + 0.00173)^{52} - 1 = 0.0941 (9.41\%) \\
\]

**Second cash flow:**

It is based on equal end-of-year deposit over 5 years with the same interest compounding.

\[ K = 1, M = 52 \\
C = \frac{M}{K} = \frac{52}{1} = 52 \\
\]

\[ i_p = i_u = (1 + i_c)^C - 1 = (1 + 0.00173)^{52} - 1 = 0.0941 (9.41\%) \\
\]

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

\[
$100 (F/A, 9.41\%, 5) + $20 (F/A, 9.41\%, 3) = F(1 + 0.0941)^5 - 1 = 0.0941 (9.41\%) \\
\]

2. Given: Quarterly cash flows at \( r = 15\% \) compounded semiannually

\[ i_p \neq i_c; M = 2; K = 4; C = \frac{M}{K} = \frac{2}{4} = 0.5; i_p = (1 + i_c)^C - 1 = \left(1 + \frac{r}{M}\right)^C - 1 \\
= \left(1 + \frac{0.15}{2}\right)^{0.5} - 1 = 0.0368 (3.68\%) \\
\]

Find: \( CE(3.68\%) \) for Machine C and D and compare for best alternative

\[
CE_C = \frac{AE_C}{i_p} \\
AE_C = -$40000(A/P, 3.68\%, 16) - $2500 + 12000(A/F, 3.68\%, 16) \\
Substitute the factors from the Formula Table 3.4 as follows:

\[ AE_C = -$40000 \left[ \frac{0.0368(1 + 0.0368)^{16}}{(1 + 0.0368)^{16} - 1} \right] - $2500 + 12000 \left[ \frac{0.0368}{(1 + 0.0368)^{16} - 1} \right] \\
AE_C = -$40000(0.0838) - $2500 + 12000(0.0470) = -$5288 \\
CE_C = \frac{-5288}{0.0368} = -$143695.65 \\
\]

\[ CE_D = \frac{AE_D}{i_p} \\
AE_D = -$60000(A/P, 3.68\%, 24) - $3000 + 25000(A/F, 3.68\%, 24) \\
\]
Substitute the factors from the Formula Table 3.4 as follows:

\[
AE_D = -$60000 \left[ \frac{0.0368(1 + 0.0368)^{24}}{(1 + 0.0368)^{24} - 1} \right] - $3000 + 25000 \left[ \frac{0.0368}{(1 + 0.0368)^{24} - 1} \right]
\]

\[
AE_D = -$60000(0.0635) - $3000 + 25000(0.0267) = -$6142.5
\]

\[
CE_D = \frac{-6142.5}{0.0368} \left( \frac{1}{1+0.0368} \right)^{24} - 1
\]

\[
CE_C = CE_D
\]

\[
-143695.65 < -166915.76
\]

**Decision:** Select Machine C based on capitalized (or quarterly) equivalent method

3.a) 

\[
D_{SL} = \frac{I - S}{N} = \frac{75000 - 0}{6} = $12500
\]

\[
B_n = I - nD = $75000 - n($12500)
\]

\[
B_N = I - ND = $75000 - 6($12500) = 0 = S
\]

\[
\alpha = \left( \frac{1}{N} \right) (Multiplier) = \left( \frac{1}{6} \right) (1.25) = 0.2083, D_n = aB_{n-1}; B_{n-1} = I(1 - \alpha)^{n-1}
\]

\[
B_N = I(1 - \alpha)^N = 75000(1 - 0.2083)^{n-1} > S \text{ use switching to SL at the beginning of year 3 (s. Table below)}
\]

b) 

\[
\alpha = \left( \frac{1}{N} \right) (Multiplier) = \left( \frac{1}{6} \right) (2.0) = 0.3333, D_n = aB_{n-1}; B_{n-1} = I(1 - \alpha)^{n-1}
\]

\[
B_N = I(1 - \alpha)^N = 75000(1 - 0.3333)^{n-1} = 75000(1 - 0.3333)^3 > S
\]

use switching to SL at the beginning of year 4 (s. Table below)

From the corresponding depreciation formulas of the methods given above and the using switching to SL for part (b) and (c) at the beginning of year 4, the results are tabulated as follows:

<table>
<thead>
<tr>
<th>n</th>
<th>SL</th>
<th>DB (α=0.2083)</th>
<th>DDB (α=0.3333)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$D_n$</td>
<td>$B_n$</td>
<td>$D_n$</td>
</tr>
<tr>
<td>0</td>
<td>75 000</td>
<td>75 000</td>
<td>75 000</td>
</tr>
<tr>
<td>1</td>
<td>12500</td>
<td>62500</td>
<td>15622.50</td>
</tr>
</tbody>
</table>
| 2 | 12500 | 50000 | 12368.33 | 12368.33> (11875.5=59377.50/5) % Do not switch to SL
| | | | 47009.17 | 16665.83 |
| | | | 16665.83>10000.5 (10000.5=50002.50/5) % Do not switch to SL | 33336.67 |
| 3 | 12500 | 37500 | 9792.01 | 9792.01<11752.29 (11752.29=47009.17/4) % Switch to SL  
| | | | 35256.88 | 11111.11 (11111.11=33336.67/4) % Do not switch to SL | 22225.56 |
| 4 | 12500 | 25000 | 11752.29 | 11752.29 | 23504.59 | 7407.78 |
| | | | 7407.78<7408.52 (7408.52=22225.56/3) % switch to SL | 14817.04 |
| 5 | 12500 | 12500 | 11752.29 | 11752.3 | 7408.52 | 7408.52 |
| 6 | 12500 | 0 | 11752.29 | 0 | 7408.52 | 0 |