1. (35 p)
Solve for the present worth of this cash flow using at most three interest factors at 10% interest compounded annually.

![Cash Flow Diagram]

2. (35 p) Find the value of X so that the two cash flows shown in the diagram below are equivalent for an interest rate of 8% compounded yearly.

![Diagram with cash flows]

3. (30 p) a) You have $10000 available for investment in stock. You are looking for a growth stock whose value can grow to $35000 over five years. What kind of growth rate are you looking for?
b) How long will it take to save $1 million if you invest $2000 each year at 6%?
c) You are considering investing $3000 at an interest rate of 8% compounded annually for five years or investing the $3000 at 9% per year simple interest for five years. Which option is better?
d) At what rate of interest compounded annually will an investment double in six years?
1. Using two interest factors, the present worth \( P \) can be computed as follows based on the equivalent cash flow of the original one given below:

\[
P = 20(P / G, 10\%, 5) - 20(P / A, 10\%, 12)
\]

\[
= 0.96
\]

[Diagram showing cash flows for present worth calculations]

Second way (using five interest factors based on the original cash flow):

\[
P = -20(P / F, 10\%, 1) + 20(P / G, 10\%, 4)(P / F, 10\%, 1) - 20(P / A, 10\%, 7)(P / F, 10\%, 5)
\]

\[
P = -20(0.9091) + 20(4.3781)(0.9091) - 20(4.8684)(0.6209) = 0.96
\]

(Factors were taken from the Interest Table/p.885)

2. Establishing equivalence base at \( N = 5 \):

\[
200(F / A, 8\%, 5) - 50(F / P, 8\%, 1) = X(F / A, 8\%, 5) - [(200 + X)(F / A, 8\%, 2)](F / P, 8\%, 1)
\]

\[
200(5.8666) - 50(1.0800) = X(5.8666) - [(200 + X)(2.0800)](1.0800)
\]

\[
1119.32 = X(5.8666) - (200 + X)(2.2464)
\]

\[
X = 433.29
\]

(Factors were taken from the Interest Table/p.883)

3. a) $35000 = 100000(F / P, i, 5) = 100000(1 + i)^5 \text{ (Factor equation taken from Table 3.4)}

\[
i = (1 + 0.05)^{1/5} - 1 = 0.2847 (28.47\%)
\]

b) \[
100000 = 2000(F / A, 6\%, N) = 2000 \frac{(1 + 0.06)^N - 1}{0.06}
\]

\[
500 = \frac{(1 + 0.06)^N - 1}{0.06} \rightarrow 31 = (1 + 0.06)^N \rightarrow \log 31 = N \log 1.06 \rightarrow N = 58.93 \approx 59 \text{ years}
\]

(Factor equation taken from Table 3.4)

c) Option 1: Compound interest with 8%:

\[
F = P(1 + i)^N = 3000(1 + 0.08)^5 = 3000(F / P, 8\%, 5) = 3000(1.4693) = 4408
\]

Option 2: Simple interest with 9%:

\[
F = P(1 + iN) = 3000[1 + (0.09)(5)] = 4350 < 4408 \rightarrow \text{Option 1 is better}
\]

d) \[
F = P(1 + i)^N \rightarrow 2P = P(1 + i)^6
\]

\[
2 = (1 + i)^6 \rightarrow i = (2)^{1/6} - 1 = 0.1224 (12.24\%)
\]