4.1 The do-nothing (DN) alternative would be selected if none of the competing alternatives are economically feasible.

4.3 A mutually exclusive project would prohibit another while any number of independent projects can be completed within budget. (e.g., choosing more than one alternative for a new mainframe computer system would not make sense; therefore, mutually exclusive.)

4.6

![Diagram with cash flow and calculations]

\[ P_0 = -200K - 5K(P/A,10\%,5) + 40K(P/A,10\%,5) + 10K(P/G,10\%,5) = 1,296 \text{ is positive cash flow; therefore good investment.} \]

4.9 This is a problem where we must choose among alternatives with all negative cash flows. Alternative A:

\[ PW_A = 75K(P/A,6\%,3) + 100K(P/A,6\%,2)(P/F,6\%,3) = 354,441 \]

Alternative B:

\[ PW_B = 150K + 60K(P/A,6\%,5) = 402,744 \]

Alternative A cost less than alternative B; therefore, it is more economical.
4.12 Given: \( b = 4\% \) coupon rate; \( c = 4 \) payments/year; \( I = \) interest pmts (dividends) = $1,000; \( V = \) bond face value

\[ I = V b / c \]

a. Carla's grandfather has told her that he is going to give her the face value \( = V \) of the bond of the bond that he bought 15 years ago.

\[ I = V (0.04)/4 = 1000; \quad V = 100,000 \]

b. 

\[ \begin{array}{c}
0 \quad 1 \quad 2 \quad 3 \quad 4 \quad \ldots \quad n-1 \quad n \\
\$1K \quad \uparrow \quad \uparrow \quad \uparrow \quad \uparrow \quad \uparrow \quad \uparrow \\
\$100K \quad \downarrow \\
\end{array} \]

\( PP = \) quarter = \( CP = \) quarter; \( i = 4\% / \) year or \( 1\% / \) quarter

\[ PW = 0 = -100K + 1K(P/A,i,60) + 100K(P/F,i,60) \]

Bonds are normally 10, 15, 20, or 30 years: I will guess \( n = 120 \) quarters for 30 year bond. \( PW = 0 \) at \( n = 120 \); therefore it was a thirty year bond.

c. Purchase price was $95,000. The quarterly rate earned is \( i \% \) in the PW relation.

\[ PW = -95,000 + 1,000(P/A,i,60) + 100,000(P/F,i,60) \]

Solve manually by trial and error using the interest factors.

\( i = 1\%: PW = +4995 \)

\( i = 1.25\%: PW = -5505 \)

interpolation: \( 1\% + \text{fraction } \% \text{ between } 1\% \text{ and } 1.25\% \)

\( i = 1\% + 4995/(4995-(-5505)) \times .25\% = 1.119\% \)

By interpolation, the earned quarterly rate is 1.119\%. Use Equation [3.2].

Effective annual rate = \( (1.01119)^4 - 1 = 4.55\% \) per year

For a rapid spreadsheet solution, enter into single cells,

\[ =\text{RATE}(60,1000,-95000,100000) \]

To display the nominal rate of 1.11\% as the quarterly rate, then enter \[ =\text{EFFECT}(4.44\%,4) \]

to display 4.51\%. (This does not use the NPV function; it uses the rate of return function to find \( i \).)
4.22 (a) LCM is 6 years for R and T evaluation. Select vendor T.

\[
\begin{align*}
PW_R &= -75,000[1 + (P/F,10\%,2) + (P/F,10\%,4)] - 27,000(P/A,10\%,6) \\
&= -75,000[1 + 0.8264 + 0.6830] - 27,000(4.3553) \\
&= $-305,798
\end{align*}
\]

\[
\begin{align*}
PW_T &= -125,000[1 + (P/F,10\%,3)] + 30,000[(P/F,10\%,3) + (P/F,10\%,6)] - 12,000(P/A,10\%,6) \\
&= -125,000[1 + 0.7513] + 30,000[0.7513 + 0.5645] - 12,000(4.3553) \\
&= $-231,702
\end{align*}
\]

(b) Re-purchase R after 2 years. Rental is paid at the end of each year.

\[
\begin{align*}
PW_R &= -75,000[1 + (P/F,10\%,2)] - 27,000(P/A,10\%,3) \\
&= -75,000[1 + 0.8264] - 27,000(2.4869) \\
&= $-204,126
\end{align*}
\]

\[
\begin{align*}
PW_T &= -125,000 + 30,000(P/F,10\%,3) - 12,000(P/A,10\%,3) \\
&= -125,000 + 30,000(0.7513) - 12,000(2.4869) \\
&= $-132,304
\end{align*}
\]

\[
\begin{align*}
PW_{rent} &= -50,000(P/A,10\%,3) \\
&= $-124,345
\end{align*}
\]

Rental option is the cheapest for a 3-year period. A spreadsheet solution follows.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
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<td>Year</td>
<td>R</td>
<td>T</td>
<td>Year</td>
<td>R</td>
<td>T</td>
<td>Rental</td>
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<td>8</td>
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<tr>
<td>9</td>
<td>PW @ 10%</td>
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<td>-231,704</td>
<td></td>
<td>=NPV(10%,C3:C8)+C2</td>
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</tbody>
</table>

4.27 Calculate the LCC to select alternative A. All monetary terms are in $ million units.

\[
\begin{align*}
LCC_T &= -250 - 150(P/A,8\%,3) - 45 - 35(P/A,8\%,2) - 50(P/A,8\%,10) \\
&= -250 - 150(2.5771) - 45 - 35(1.7833) - 50(6.7101) - 30(3.3121) \\
&= $-1178.8485 \quad ($1,178,848,500)
\end{align*}
\]

\[
\begin{align*}
LCC_A &= -10 - 45 - 30(P/A,8\%,3) - 100(P/A,8\%,10) - 40(P/A,8\%,10) \\
&= -10 - 45 - 30(2.5771) - 100(6.7101) - 40(6.7101) \\
&= $-1071.7270 \quad ($1,071,727,000)
\end{align*}
\]
\[
\text{LCC}_C = -190(\text{P/A,}8\%,10)
\]
\[
= -190(6.7101)
\]
\[
= -1274.919 \quad (\$-1,274,919,000)
\]

4.31 (a) \[
\text{CC} = -85,000,000 - \frac{550,000(A/F,8\%,3)}{0.08} + 18,500,000
\]
\[
= -85,000,000 - 6,875,000(0.30803) + 231,250,000
\]
\[
= \$+144,132,294
\]

(b) Use Equation [4.3] to calculate A.

\[
A = \text{CC}(i) = 144,132,294(0.08)
\]
\[
= \$11,530,584
\]

The A means that the toll road should have an equivalent annual cash-flow of approximately \$11.53 million for the foreseeable future.

4.41 (a) Select 2, 3 and 4 with PW > 0 at 12%.

(b) Of 2^4 = 16 bundles, list acceptable bundles and PW values. Select projects 2 and 3 with largest PW = \$9000.

<table>
<thead>
<tr>
<th>Bundle</th>
<th>Investment</th>
<th>PW</th>
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</thead>
<tbody>
<tr>
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<td>0</td>
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<td>34</td>
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<td>8,100</td>
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