5.5

\[
\begin{array}{cccc}
0 & 1 & 2 & 3 & 4 \\
C & C & C & C & C \\
30 \\
\end{array}
\]

The 10% annual yield indicates that the semiannual interest rate \( r \) is 5%.

\[
P = C \times A_r^T + \frac{F}{(1 + r)^T}
\]

\[
$923.14 = C \times A_{5\%}^{30} + \frac{1,000}{1.05^{30}}
\]

\[
$923.14 = C \times \frac{1}{0.05} \left(1 - \frac{1}{1.05^{30}}\right) + \frac{1,000}{1.05^{30}}
\]

\[
$923.14 = C \times 15.3725 + 231.4
\]

\[C = \$44,998.5
\]

The semiannual coupon is $44,998.5, so the annual coupon is $44,998.5 \times 2 = $89,997.0.

The coupon rate = \[
\frac{\$89,9970}{\$1,000} = 8.997%
\]

5.7

(a) When the coupon rate equals to the market interest rate, the bonds are sold at par value. Therefore, the prices of the two bonds are all $1,000.

(b) For both bond A and B, the annual coupon \( C = $1,000 \times 10\% = $100 \)

\[
P_A = CA_r^T + \frac{F}{(1 + r)^T} = $100 \times \frac{1}{0.12} \left(1 - \frac{1}{1.12^{20}}\right) + \frac{1,000}{1.12^{20}}
\]

\[= $100 \times 7.4694 + $103.7 = $850.64
\]

\[
P_B = CA_r^T + \frac{F}{(1 + r)^T} = $100 \times \frac{1}{0.12} \left(1 - \frac{1}{1.12^{10}}\right) + \frac{1,000}{1.12^{10}}
\]

\[= $100 \times 5.6502 + $322.0 = $887.02
\]

(c) \( P_A = CA_r^T + \frac{F}{(1 + r)^T} = $100 \times \frac{1}{0.08} \left(1 - \frac{1}{1.08^{20}}\right) + \frac{1,000}{1.08^{20}}
\]

\[= $100 \times 9.8181 + $214.5 = $1196.31
\]

\[
P_B = CA_r^T + \frac{F}{(1 + r)^T} = $100 \times \frac{1}{0.08} \left(1 - \frac{1}{1.08^{10}}\right) + \frac{1,000}{1.08^{10}}
\]

\[= $100 \times 6.7101 + $463.2 = $1134.21
\]

5.10

<table>
<thead>
<tr>
<th>(1/yr)</th>
<th>(6/yr)</th>
<th>(14/yr)</th>
<th>(30/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond A</td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>$2,000</td>
</tr>
<tr>
<td>Bond B:</td>
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<td>3</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
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<td>0</td>
<td>$4,000</td>
<td>$2,000</td>
</tr>
</tbody>
</table>
Semianual interest rate r=12%/2=6%

\[ P_A = \frac{2000 * A_{12}^6}{1.06^{12}} + \frac{2500 * A_{12}^{12}}{1.06^{28}} + \frac{40000}{1.06^{40}} \]

\[ = \frac{2000 * 10.1059}{1.06^{12}} + \frac{2500 * 8.3838}{1.06^{28}} + \frac{40000}{1.06^{40}} = 18033.82 \]

\[ P_B = \frac{40000}{1.06^{40}} = 3888.89 \]

5.11

(a) True. ATT51/803 is the bond with the shortest time to maturity. 100 under the heading “Close” implies that the closing price for the bond is 100% of its face value, $1,000.

(b) True. ATT9S18 has a coupon rate of 9%, so the annual coupon is $90.

(c) True. Let X be the on the day before this quotation. The current bond price is 107.375% of its face value, which is $1,073.75. The price dropped by 0.125 of 1 percent, which is 0.00125. So,

\[ \frac{($1073.75-X)}{X}=-0.00125 \]

\[ X=$1075.94 \]

(d) True: A/F&7/1/804 means that the current yield is 7.125%.

(e) True. Both AT&T bonds are sold beyond par value; therefore the coupon rate must be higher than the yield to maturity.

(d) Correction: FALSE. The current yield is the annual coupon payment divided by the price of the bond. In this case the current yield is \( \frac{71.25}{1041.25} = 6.84\% \).
1.

a. What are the selling prices of each of the two bonds?

Zero-coupon bond

\[ PV = \frac{F}{(1+r)^T} = \frac{1,000}{1.1^{20}} = 148.64 \]

Coupon bond

\[ PV = \frac{C}{r} \left[ 1 - \left( \frac{1}{1+r} \right)^T \right] + \frac{F}{(1+r)^T} = \]

\[ = \frac{100}{0.1} \left[ 1 - \left( \frac{1}{1.1} \right)^{20} \right] + \frac{1,000}{(1.1)^{20}} = 1,000 \]

b. Assume that the tax bracket on personal income is 30%. Compute the after-tax rate of return on each of the bonds at the end of period 1.

At the end of period 1 the coupon bond will have paid the coupon of \$100. Total income is \$100, and the before-tax yield is therefore 10 percent. However, the \$100 coupon payment generates tax obligations of

\[ 30\% \times 100 = 30, \]

and results in only \$70 net income. The after-tax rate of return is then

\[ \frac{100 - 30}{100} = 7\%. \]

The zero-coupon bond pays no coupons and therefore we need to look at its price at the end of period 1. This bond at the end of period 1 will sell at

\[ PV = \frac{F}{(1+r)^T} = \frac{1,000}{1.1^{19}} = 163.51 \]

since \( T = 20 - 1 = 19 \). That is, the zero-coupon bond will have increased in price by

\[ \frac{163.51 - 148.64}{148.64} = 10\%, \]

that is, a pretax gain of 10%. However, the gain of \$14.87 (\$163.51 - \$148.64) is treated by the IRS as imputed interest, and a 30% of it is taxed away.

Therefore, the net-of-tax increase in value for the zero is

\[ 14.87 - 30\% \times 14.87 = 10.409, \]

that means an after-tax rate of return of

\[ \frac{10.41}{148.64} = 7\%. \]

Conclusion: for both bonds the after-tax yield equals \( 10\% \times (1 - 0.3) = 7\% \).