Midterm Solutions

1. (a) False. The goal of a manager should always be to maximize the market value of the firm. The firm’s risk will be reflected in its market value and shareholders can always unload any undesirable risk in the market. (Caveat: It could be true if shareholders can’t sell or have blocked access to financial markets like in private firms).

(b) False. The cost of capital is the expected return that is foregone by investing in a project rather than in comparable securities. Absent market frictions and capital constraints, the cost of capital does not depend on the amount of cash that a firm has on hand.

(c) False. The term structure of interest rates depends on expected future interest rates, if short term interest rates are expected to decrease substantially, the term structure can be inverted, flat, or downward sloping even when there is a liquidity premium for long term interest rates.

(d) False. Bonds with higher duration are more sensitive to changes in interest rates. If we examine coupon bonds, all things equal a bond with a higher coupon rate will have a lower duration and thus be less sensitive to changes in interest rates.

(e) False. The choice of the horizon date should not affect the present value. If it does, you’ve made a mistake.

(f) False. Absent capital constraints, when we choose between two alternative projects the one with the highest NPV always dominates. If there are capital constraints rank for NPV per dollar invested. Higher IRR does not uniformly imply higher NPV, thus a higher IRR does not imply that one project dominates the other.

2. (a)

\[ \begin{align*}
95.92 & = \frac{100}{1 + r_1} \\
92.01 & = \frac{100}{(1 + r_2)^2} \\
87.00 & = \frac{100}{(1 + r_3)^3}
\end{align*} \]

\[ \begin{align*}
r_1 & = \frac{100}{95.92} - 1 = 4.25\% \\
r_2 & = \left( \frac{100}{92.01} \right)^{1/2} - 1 = 4.25\% \\
r_3 & = \left( \frac{100}{87.00} \right)^{1/3} - 1 = 4.75\%
\end{align*} \]
(b) \[ f_{2,3} = \frac{(1 + r_3)^3 - 1}{(1 + r_2)^2} = 5.76\% \]

(c) The yield to maturity is simply 4.25% since the one year and two year spot rates are roughly equivalent, more specifically when we calculate the present value of a coupon bond with a coupon rate of 4.25% this bond has a current price at par.

\[ PV = \frac{4.25}{1 + r_1} + \frac{104.25}{(1 + r_2)^2} \]
\[ = \frac{4.25}{1.0425} + \frac{104.25}{(1.0425)^2} = 100 \]

3. (a) Using the perpetuity formula

\[ PV_{Liability} = \frac{10M}{r} = \frac{10M}{0.05} = 200M \]

(b) \[ PV_{Liability} = \frac{10M}{r} = \frac{10M}{0.049} = 204.0816M \]

The value of the liabilities would increase by 4.0816M.

(c) \[ P_{new} = P_{old} - P_{old} \times MD \times \Delta y \to MD = \frac{P_{old} - P_{new}}{P_{old} \times \Delta y} = \frac{200 - 204.0816}{200 \times -0.001} = 20.4082 \]

(d) You should match the duration to neutralize first order interest rate risk.

\[ D = MD(1 + y) = 20.4082 \times (1.05) = 21.4286 \]

(e) We must match both the duration and the present value of the zero coupon bond. Let \( PAR \) be the par value of the zero coupon bond and \( t \) be the maturity. Since the duration of a zero coupon bond is its maturity \( t = 21.4286 \). We can then solve for the \( PAR \) value

\[ 200M = \frac{PAR}{(1.05)^t} \to PAR = 200(1.05)^{21.4286} = 568.9661M \]
4. (a) Using the Gordon Growth Model, we can solve for the value of $g$.

$$P = \frac{D_1}{r - g}$$

$$20 = \frac{0.5}{0.1 - g}$$

$$g = 0.1 - \frac{0.5}{20} = 7.50\%$$

(b) $g = ROE \times b$ where $b$ is the plowback ratio $b = \frac{0.75}{1.25} = 0.6$, thus

$$ROE = \frac{g}{b} = \frac{0.075}{0.6} = 12.5\%$$

(c) MW Co. is a growth company since ROE on its new investments (12.5%) is higher than the cost of capital (10%).

5. Answers will vary, but we examine one possible solution where we make the following assumptions and observations.

- Last year’s 10M is a sunk cost (forget it in PV) but we can’t forget its depreciation.
- Assume that 10M last year can be carried over without capitalized interest and all depreciation is realized in year 1, 2, 3, and 4. Then we are depreciating $10M + 10M = 20M$ over 4 years linearly (more specifically 5M can be depreciated in years 1, 2, 3 and 4 resulting in a 1.5M tax shield).
- Pre-tax earnings are revenues minus operating costs (i.e. depreciation is not included in pre-tax earnings).
- Assume that there is no carry over of taxes because MyWay will be part of Googol a mature company which we assume has sufficient earnings (i.e. there will be no need to carry over taxes if Googol purchases MyWay).

(a) We can compute the following after tax cash flows where after time $t = 4$, there is no longer any depreciation so the cash flows will grow at a rate of 5%.

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre-tax earn</td>
<td>0</td>
<td>2</td>
<td>2(1.05)</td>
<td>2(1.05)^2</td>
<td>2(1.05)^3</td>
<td>2(1.05)^4</td>
</tr>
<tr>
<td>after-tax earn ($earn \times (1 - \tau)$)</td>
<td>0</td>
<td>1.4</td>
<td>1.47</td>
<td>1.5435</td>
<td>1.6207</td>
<td>1.7017</td>
</tr>
<tr>
<td>tax shield ($dep \times \tau$)</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>total after tax</td>
<td>-10</td>
<td>2.9</td>
<td>2.97</td>
<td>3.0435</td>
<td>3.1207</td>
<td>1.7017</td>
</tr>
</tbody>
</table>

(b) Using the $P/E$ ratio for mature companies in the same business as MyWay with no growth opportunities we can estimate the opportunity cost of capital for MyWay $r = \frac{1}{P/E} = 1/8 = 12.5\%$. 


(c) Discounting the after tax cash flows where we evaluate the cash flows after
time 4 by discounting the dividend discount formula with growth where $PV_4 = \frac{1.7017}{0.125-0.05} = 22.6893$:

$$
PV = -10 + \frac{2.9}{1.125} + \frac{2.97}{1.125^2} + \frac{3.0435}{1.125^3} + \frac{3.1207}{1.125^4} + \frac{PV_4}{1.125^4} = 13.1751
$$