Question 1 (6 points) Consider the following statement, state whether it is true or not, and explain why it is true or not. For full marks, show your calculations, be precise and concise, use a graph.

Statement: You have the following information on the net present value of a project called Project A:

\[ \text{NPV}_A > 0 \text{ for cost of capital } k < 12\% \]
\[ \text{NPV}_A < 0 \text{ for cost of capital } k > 12\% \]

Your firm is 100% internally equity financed and you use CAPM to calculate your cost of internal equity. The risk-free rate of return is 2% and \( r_M = 6\% \). Then for IRR method to accept this project, your company beta should be less than 2.5.

\[ \text{IRR}_A = 12\% \]

\[ \text{IRR} \text{ accepts if } \]

\[ \text{IRR}_A = 12\% > r_F + \beta_s (r_M - r_F) \]

\[ \Rightarrow 12\% > 2\% + \beta_s (6\% - 2\%) \]

\[ \beta_s < 2.5 \]

Statement is False
Question 2 (6 points) Consider the following statement, state whether it is true or not, and explain why it is true or not. For full marks, be precise and concise and use a graph.

Statement: You are evaluating two projects A and B. You can only choose one of the two projects, but not both. You have the following information on the IRRs and NPV schedules of the two projects

\[ IRR_A = 10\% \text{ and } IRR_B = 8\% \]

\[ NPV_A > NPV_B \text{ for all } k < 12\% \]
\[ NPV_A < NPV_B \text{ for all } k > 12\% \]

Then in this situation both NPV and IRR methods always yield the same decision.

<table>
<thead>
<tr>
<th>k</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;8%</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>8%</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>10%</td>
<td>Reject both</td>
<td>Reject both</td>
</tr>
<tr>
<td>12%</td>
<td>Reject both</td>
<td>Reject both</td>
</tr>
</tbody>
</table>

Yes both NPV and IRR always yield the same decision.

Statement is True.
Question 3 (6 points) Consider the following statement, state whether it is true or not, and explain why it is true or not. For full marks, be precise and concise.

Statement: A company can avoid issuing external equity by reducing its capital budget and/or by reducing its dividend payout ratio.

True since internal equity requires

\[ I (1-x) > w_e B. \]

Reduces B makes right hand side smaller and it becomes easier to satisfy above requirement.

Similarly reduces x makes left hand side bigger again making it easy to satisfy above requirement.
Question 4 (6 points) Consider the following statement, state whether it is true or not, and explain why it is true or not. For full marks, show your calculation, be precise and use a graph.

Statement: You are evaluating two projects A and B. You can only choose one of the two projects, but not both. Let \( k \) denote your cost of capital. You have the following information on the NPVs of the two projects:

\[
NPV_A > NPV_B \text{ for all } k < 8% \\
NPV_A < NPV_B \text{ for all } k > 8%
\]

You also know that \( IRR_A = 10\% \) and that both projects have the same initial cost. One can then conclude that Project A has a shorter payback, that is, it recovers its initial cost earlier than Project B.

Project A has a steeper NPV schedule indicating its larger cash flows in late years. Hence B must have a shorter payback.

Statement is False.
Question 5 (6 points) Consider the following statement, state whether it is true or not, and explain why it is true or not. For full marks, be precise.

Statement: Suppose you are evaluating a two year project. Suppose, in contrast to your initial expectations, the initial cost to undertake the project increases. Then both the IRR and MIRR of this project will decrease.

**IRR is defined as**

\[ \text{NPV at } IRR = 0. \]

As initial cost increases IRR decreases.

**MIRR is defined as**

\[
(1 + MIRR)^2 = \frac{\text{Future Value}}{\text{Initial Cost}}
\]

As initial cost increases MIRR decreases

Statement is True.
Question 6 (25 points): A company finances its operations with 40 percent debt and 60 percent equity. Its net income is \( I = \$24 \) million and it has a dividend payout ratio of \( x = 25\% \). Its capital budget is \( B = \$25 \) million this year. The interest rate on company's debt is \( r_d = 10\% \) and the company's tax rate is \( T = 40\% \). The company's common stock trades at \( P_0 = \$66 \) per share, and its next dividend of \( D_1 = \$6.6 \) per share is expected to grow at a constant rate of \( g = 10\% \) a year. The flotation cost of external equity is \( F = 5\% \) of the dollar amount issued.

a) (15 points) What is the company's WACC?

\[
\begin{align*}
\omega_e B &= 0.60 \times 25 = 15M \\
I(1-x) &= 24 \times (1-0.25) = 18M \\
\text{Since } I(1-x) > \omega_e B &\implies \text{internal equity} \\
\text{Cost of internal equity} &= \frac{D_1}{P_0} + g = \frac{6.6}{66} + 10\% = 20\%
\end{align*}
\]

\[
\begin{align*}
\text{WACC} &= \omega_d r_d (1-T) + \omega_e \text{re} + F \\
\text{WACC} &= 0.40 \times 0.10 \times (1-0.4) + 0.6 \times 0.20 \\
&= 2.4\% + 12\% \\
\text{WACC} &= 14.4\%
\end{align*}
\]
b) (10 points) What is the highest dividend payout ratio $x$ that the company can implement if the company wants to expand its capital budget to $B = $32 million without issuing new stock?

\[ I(1-x) > w_c B \]

\[ 24M(1-x) > 0.6 (32M) \]

\[ (1-x) > \frac{0.6 (32M)}{24M} \]

\[ x < 20\% \]
Question 7 (20 points): (IRR) Consider a company which uses only debt (bonds) to finance its capital budget. The company is considering a 10 year project which requires a date 0 outlay of $67,100 and generates $10,000 in each of the following 10 years. The company is subject to a tax rate of $T=20\%$. What is the highest yield $r_d$ annual on the company’s bonds that would allow to undertake the project according to the IRR method?

To find IRR, note that

$$\text{NPV at } IRR = 0$$

$$-67,100 + (10,000)(PVIFA)_{0,IRR} = 0$$

$$(PVIFA)_{10,IRR} = 6.71$$

$$IRR = 8\%$$

We need

$$IRR > r_d (1-T)$$

$$8\% > r_d (1-0.20)$$

$$\Rightarrow r_d < 10\%$$
Question 8 (25 points) (Modified IRR): Your firm is 100% debt financed and the yield on your bonds is given by \( r_d = 10\% \). Your firm is subject to a tax rate of 30%. Suppose you are evaluating a two year project using the MIRR criteria. The project will generate a fixed positive cash flow \( x \) for both of the next two years. The initial cost of the project is $50,000. What is the minimum positive annual cash flow \( x \) such that the MIRR criteria recommends accepting the project?

\[
\text{Cost of Capital} = r_d (1 - T) = 10\% (1 - 0.3) = 7\%
\]

\[
\text{Future Value} = x \times (PVA_{2,7\%}) = (2.07)x
\]

\[
\text{MIRR} = \sqrt[2]{\frac{\text{Future Value}}{\text{Initial Cost}}} - 1 \geq \frac{0.07}{\text{Cost of capital}}
\]

\[
\Rightarrow \quad \frac{(2.07)x}{50,000} \geq (1.07)^2.
\]

\[
x \geq \frac{(1.07)^2 \times 50,000}{2.07}.
\]

\[
x \geq 27,654
\]
Question 1 (25 points): A company with a stock price $P_0 = $108 had a constant dividend growth rate last estimated to be $g = 8\%$. Suppose now that the market updates its beliefs on the constant dividend growth rate, and it is now estimated to be $g^{\text{new}} = 4\%$. After this new estimate, the stock price went down to $P_0^{\text{new}} = $52. The required rate of return on the market portfolio is $r_m = 6\%$ and the risk-free rate is $2\%$ and did not change. The company's beta also remained the same.

a) (15 points) What is the last dividend $D_0$ of the company?

\[
D_0 \left( \frac{1.08}{108} \right) + 0.08 = D_0 \left( \frac{1.04}{52} \right) + 0.04
\]

\[
(0.01)D_0 + 0.08 = (0.02)D_0 + 0.04
\]

\[
0.04 = (0.01)D_0
\]

\[
D_0 = 4
\]
b) (10 points) What is the beta of the company?

\[ 12\% = 2\% + \beta_5 (6\% - 2\%) \]

\[ \beta_5 = 2.5 \]

---

Note that with \( D_0 = \$4 \),
we have \( r_s = 0.02 (4) + 0.04 = 12\% \)

Hence

\[ 12\% = r_{FP} + \beta_5 (r_m - r_{FP}) \]

\[ 12\% = 2\% + \beta_5 (6\% - 2\%) \]

\[ \beta_5 = 2.5 \]
Question 3 (25 points): A company recently paid a dividend of $1.00 per share ($D_0 = $1). The company has a constant dividend growth rate of $g = 8\%$ and a beta equal to 2. The required rate of return on the market is $r_M = 8\%$ and the risk-free rate is $r_{RF} = 2\%$.

a) (10 points) What should be the company’s stock price according to the constant dividend growth rate model?

\[ \frac{1.08}{0.14 - 0.08} = \frac{1.08}{0.06} \]

\[ p_0 = 18 \]

Note that \( r_S = 2\% + 2(8\% - 2\%) = 14\% \)

\[ \Rightarrow p_0 = \frac{D_0 (1+g)}{r_S - g} = \frac{1 (1+0.08)}{0.14 - 0.08} \]

\[ \Rightarrow p_0 = \frac{1.08}{0.06} \Rightarrow p_0 = 18 \]
b) (15 points) The company is considering a change of policy which will reduce its $g$ to 5%. If market conditions remain unchanged, what new beta will cause the stock price of the company to remain unchanged?

\[ r_s^{\text{new}} = \frac{1.05}{18} + 0.05 \]

\[ r_s^{\text{new}} = 10.83\% \]

\[ 10.83\% = 2\% + \beta (6\%) \]

\[ \beta = \frac{8.83\%}{6\%} = 1.47 \]
Question 3 (13 points): A company recently paid a dividend of $2 per share ($D_0 = $2). The company had a constant dividend growth rate last estimated to be $g = 3\%$. Suppose now that the market updates its beliefs on the constant dividend growth rate, and it is now estimated to be $g_{\text{new}} = 4\%$. After this new estimate, the stock price be $P^\text{new}_0 = $52. The required rate of return on the market portfolio is $r_m = 6\%$ and the risk-free rate is $2\%$ and did not change. The company's beta also remained the same. What was the price $P_0$ before the change in $g$?

\[ \frac{2(1.03)}{P_0} + 0.03 = \frac{2(1.04)}{52} + 4\% \]

\[ \frac{2.06}{P_0} + 0.03 = 0.08 \]

\[ P_0 = \frac{2.06}{0.05} \]

\[ P_0 = 41.2 \]
Question 4 (13 points): Suppose a company conducts a study to evaluate the benefits and costs of selling off their secondary business.

In particular, if they keep their secondary business, they will have $\beta_s^{\text{current}} = 1.6$ and $g = 8\%$.

If they sell it off, they will have a new beta given by $\beta_s^{\text{new}}$ and $g^{\text{new}} = 6\%$.

The last dividend of the company was $D_0 = $1.

Assume that $r_M = 8\%$ and risk free rate is $r_{RF} = 4\%$.

If the company is trying to maximize its current stock price, what is the highest value of $\beta_s^{\text{new}}$ such that the company is better off selling the secondary business.

\[ r_s^{\text{without sell off}} = 4\% + 1.6 \times (4\%) = 10.4\% \]

\[ p_0^{\text{current}} = \frac{1.08}{0.104 - 0.08} = \frac{1.08}{0.024} = 45 \]

\[ p_s^{\text{new}} = \frac{1.06}{r_s^{\text{new}} - 0.06} > 45 \]

\[ r_s^{\text{new}} \leq 8.3\% \]

\[ 4\% + \beta_s^{\text{new}} (4\%) \leq 8.3\% \]

\[ \beta_s^{\text{new}} < \frac{4.3\%}{4\%} \Rightarrow \beta_s^{\text{new}} = 1.075 \]
True False Questions (3 points each, 24 points total)

- Suppose the stock’s beta increases. The risk free rate \( r_{RF} \) and return on market portfolio \( r_M \) both remain the same, and the dividend growth rate \( g \) goes UP. Then dividend return on the stock must go down.
  
  \[ \text{False} \]

- Suppose, the company beta increases, the risk free rate and return on market portfolio remain the same. For the stock price to remain constant, the dividend growth rate estimate \( g \) must go down.
  
  \[ \text{False} \]

- Suppose the required return \( r_M \) on the market portfolio increases, the dividend growth rate estimate \( g \) goes up, and company beta remains constant. This implies that the dividend return on the stock must DECREASE?
  
  \[ \text{False} \]

- If the market lowers its estimate of a company’s beta, increases its dividend growth estimate \( g \) and all else constant, this means dividend return must increase.
  
  \[ \text{False} \]

- If the capital gains return on a stock goes up and all else is the same and then this means the stock price also goes up.
  
  \[ \text{True} \]

- Suppose the company beta, risk free rate and return on market portfolio remain the same, and the dividend growth rate \( g \) goes down. This implies that the dividend yield on the stock must increase.
  
  \[ \text{True} \]
• Suppose the company beta increases, the risk free rate and return on market portfolio remain the same. For the stock price to remain constant, the capital gains return must increase.

\[ \text{True} \]

• Suppose the required return \( r_M \) on the market portfolio increases, the dividend growth rate estimate \( g \) goes down, and company beta remains constant. This implies that the dividend yield on the stock must increase.

\[ \text{True} \]

\[ r_f \leq r_g \]
True or False Questions (3 points each)

For the next 4 True False Questions below, consider a 20 year bond with annual coupon rate of 12% and coupons are paid semiannually. Assume that $r_d \text{ annual} = 10\%$.

- The current value of this bond will be less than the par value of $1000
  \[ \text{FALSE} \]

- If the $r_d \text{ annual}$ remains at 10% after 6 months, the value of this bond will INCREASE
  \[ \text{FALSE} \]

- If the $r_d \text{ annual}$ remains at 10% after 6 months, the 6 month coupon return on this bond will be higher than 6%
  \[ \text{TRUE} \]

- The duration of this bond will be shorter than the duration of a 20 year bond with 10% annual coupon rate.
  \[ \text{TRUE} \]
For the next 4 True False questions below, consider a 10 year bond with annual coupon rate of 10% and coupons are paid semiannually. Assume that \( r_d \) annual = 10%.

- The current value of this bond will be less than the par value of $1000
  .................FALSE

- If the \( r_d \) annual remains at 10% after 6 months, the value of this bond will DECREASE
  .................FALSE

- If the \( r_d \) annual remains at 10% during the next 24 months, the 6 month coupon return on this bond will remain below 5% and increase over the course of the next 24 months.
  .................FALSE

- The duration of this bond will be shorter than the duration of a 10 year bond with 8% annual coupon rate
  .................TRUE
For the next 2 True False questions below, consider

(i) Bond A: 20 year bond with annual coupon rate of 10%
(ii) Bond B: 10 year bond with annual coupon rate of 10%
(iii) Bond C: 20 year bond with annual coupon rate of 8%

- Bond A will decline the least in value if interest rates go up.  
  \textcolor{red}{\text{FALSE}}

- Bond C will gain the most in value if interest rates go down.  
  \textcolor{green}{\text{TRUE}}