第 1 题  CML （第 10 章，#31，316 頁。）
The market portfolio has an expected return of 12 percent and a standard deviation of 10 percent.
The risk-free rate is 4 percent.
a. What is the expected return on a well-diversified portfolio with a standard deviation of 7 percent?
b. What is the standard deviation of a well-diversified portfolio with an expected return of 20 percent?
【分析】
CML:  \( r = r_f + b \times \sigma_i \)
\( r_m = 12\%, \sigma_m = 10\%, r_f = 4\% \Rightarrow b = 0.8 \)

(a) \( \sigma_a = 7\% \Rightarrow r_a = 4\% + 0.8 \times 0.07\% = 9.6\% \)
(b) \( r_b = 20\% \Rightarrow \sigma_b = (20\% - 4\%)/0.8 = 20\% \)

第 2 题  SML （第 10 章，#35，317 頁。）
Suppose you observe the following situation:
Assume these securities are correctly priced. Based on the CAPM, what is the expected return on the market? What is the risk-free rate?
【分析】
SML:  \( r_i = r_f + \beta_i (r_m - r_f) \)
\( \beta_1 = 1.3, \beta_1 = 0.23 \Rightarrow r_f + 1.3 \times (r_m - r_f) = 0.23 \Rightarrow r_f = 0.044 \)
\( \beta_2 = 0.6, r_2 = 0.13 \Rightarrow r_f + 0.6 \times (r_m - r_f) = 0.13 \Rightarrow r_m = 0.187 \)

<table>
<thead>
<tr>
<th>Security</th>
<th>Beta</th>
<th>Expected Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliance Co.</td>
<td>1.3</td>
<td>0.23</td>
</tr>
<tr>
<td>Alliance Co.</td>
<td>0.6</td>
<td>0.13</td>
</tr>
</tbody>
</table>
第 3 题 Standard Deviation and Beta  （第 10 章，#38，318 頁。）

There are two stocks in the market, stock A and stock B. The price of stock A today is €50. The price of stock A next year will be €40 if the economy is in a recession, €55 if the economy is normal, and €60 if the economy is expanding. The probabilities of recession, normal times, and expansion are .1, .8, and .1, respectively. Stock A pays no dividends and has a correlation of .8 with the market portfolio. Stock B has an expected return of 9 percent, a standard deviation of 12 percent, a correlation with the market portfolio of .2, and a correlation with stock A of .6. The market portfolio has a standard deviation of 10 percent. Assume the CAPM holds.

a. If you are a typical, risk-averse investor with a well-diversified portfolio, which stock would you prefer? Why?
b. What are the expected return and standard deviation of a portfolio consisting of 70 percent of stock A and 30 percent of stock B?
c. What is the beta of the portfolio in part (b)?

【分析】

\( \sigma \) 和 \( \beta \) 的關係如下:

\[
\beta_i = \frac{\sigma_{i,M}}{\sigma_M} \quad \rho_{i,M} = \frac{\sigma_{i,M}}{\sigma_i \times \sigma_M} \quad \Rightarrow \quad \beta_i = \rho_{i,M} \times \frac{\sigma_i}{\sigma_M}
\]

抽樣分配 \( aX + bY \) 的期望值、變異數、共變數:

\[
E(aX + bY) = aE(X) + bE(Y), \quad V(aX + bY) = a^2 V(X) + b^2 V(Y) + 2ab \text{cov}(X,Y)
\]

題目給定資料:

\( r_A = 8\%, \sigma_A = 9.8\%, \rho_{A,M} = 0.8, \quad r_B = 9\%, \sigma_B = 12\%, \rho_{B,M} = 0.2, \quad \rho_{A,B} = 0.6, \quad \sigma_M = 10\% \)

轉換成共變數並計算 \( \beta \):

\[
\sigma_{A,M} = \rho_{A,M} \times \sigma_A \times \sigma_M =, \quad \sigma_{B,M} = \rho_{B,M} \times \sigma_B \times \sigma_M =, \quad \sigma_{A,B} = \rho_{A,B} \times \sigma_A \times \sigma_B =
\]

\[
\beta_A = \frac{\sigma_{A,M}}{\sigma_M \times \sigma_M}, \quad \beta_B = \frac{\sigma_{B,M}}{\sigma_M \times \sigma_M}
\]

(a) 風险規避者會選風險較小的 Stock B。

(b) 投資組合 \( C = 0.7A + 0.3B \)

\[
r_C = 0.7 \times r_A + 0.3 \times r_B =, \quad \sigma_C = \sqrt{0.7^2 \sigma_A^2 + 0.3^2 \sigma_B^2 + 2 \times 0.7 \times 0.3 \times \sigma_{A,B}} =
\]

(c)

\[
\sigma_{C,M} = 0.7\sigma_{A,M} + 0.3\sigma_{B,M} \quad \Rightarrow \quad \beta_C = 0.7\beta_A + 0.3\beta_B =
\]
<table>
<thead>
<tr>
<th>報酬</th>
<th>機率</th>
<th>σA</th>
<th>σB</th>
<th>σM</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20%</td>
<td>0.1</td>
<td>9.80%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>10%</td>
<td>0.8</td>
<td>12%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>20%</td>
<td>0.1</td>
<td>12%</td>
<td>12%</td>
<td>10%</td>
</tr>
</tbody>
</table>

A權重 = 0.7  
B權重 = 0.3  

rA = 8.00%  
rB = 9%  
rC = 8.30%  
σC = 9.47%  
βC = 0.621
第 4 题 Finding the WACC （第 12 章，#12，364 頁。）

Aasirn Mining Corporation has 9 million shares of common stock outstanding and 120,000 8.5 percent semiannual bonds outstanding, par value BND 1,000 each. The common stock currently sells for BND 34 per share and has a beta of 1.20, and the bonds have 15 years to maturity and sell for 93 percent of par. The market risk premium is 10 percent, T-bills are yielding 5 percent, and Aasim Mining's tax rate is 35 percent.

a. What is the firm's market value capital structure?

b. If Aasim Mining is evaluating a new investment project that has the same risk as the firm's typical project, what rate should the firm use to discount the project's cash flows?

【分析】
普通股，9,000,000 股在外，每股成本未知；
公司債，120,000 口在外，每口面額$1,000，利息 8.5%，每半年給息一次。
普通股每股市價$34，β=1.2 ：公司債 15 年後到期，市價為面額之 93%。
其他資料： \( r_M - r_f = 10\% \)， \( r_f = 5\% \)， \( T = 35\% \)。

(a)
權益、公司債市值： \( S = 34 \times 9,000,000 = \)， \( B = 1,000 \times 93\% \times 120,000 = \)

(b)
\[
\begin{align*}
S_B &= r_f (1 - T) \\
r_WACC &= \frac{S}{S + B} \times r_S + \frac{B}{S + B} \times r_B \times (1 - T)
\end{align*}
\]

<table>
<thead>
<tr>
<th>普通股： 9,000,000</th>
<th>市價： $34</th>
<th>β = 1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>公司債： 120,000</td>
<td>面額： $1,000</td>
<td>年利率： 8.50%</td>
</tr>
<tr>
<td>rM - rf = 10%</td>
<td>rf = 5%</td>
<td>T = 35%</td>
</tr>
<tr>
<td>S = 306,000,000</td>
<td>B = 111,600,000</td>
<td>折現率 = 4.69%</td>
</tr>
<tr>
<td>rS = 17.00%</td>
<td>rB = 9.38%</td>
<td>公司債價值 = $930.00</td>
</tr>
</tbody>
</table>
第 5 题 Preferred Stock and WACC （第 12 章，#15，365 頁。）

The Saunders Investment Bank has the following financing outstanding. What is the WACC for the company?

**Debt:** 50,000 bonds with an 8 percent coupon rate and a quoted price of £119.80; the bonds have 25 years to maturity. 150,000 zero coupon bonds with a quoted price of £13.85 and 30 years until maturity.

**Preferred stock:** 120,000 shares of 6.5 percent preferred with a current price of £112, and a par value = £100.

**Common stock:** 2,000,000 shares of common stock; the current price is £65, and the beta of the stock is 1.1.

**Market:** The corporate tax rate is 40 percent, the market risk premium is 9 percent, and the risk-free rate is 4 percent.

【分析】

公司債 1: 50,000 口，利息 8％（半年給息一次），25 年到期，每口報價 $119.80；
公司債 2: 150,000 口，不給利息，30 年到期，每口報價 $13.85；
特別股: 120,000 股，每年給股利 6.5％，面額 $100，每股市價 $112；
普通股: 2,000,000 股，每股市價 $65，$100，β = 1.1。
其他資料: $M - r_f = 9％ 、 r_f = 4％ 、 T = 40％。

附息公司債市值: $B_1 = 50,000 \times \frac{1,000 \times 1.1980}{2} = 59,900,000$
無息公司債市值: $B_2 = 150,000 \times 1.0385 \times 150,000 = 20,775,000$
特別股，普通股市值: $S_1 = $112 \times 120,000 = 13,440,000$，$S_2 = $65 \times 2,000,000 = 130,000,000$

$r_f = \frac{\text{股利}}{\text{股價}} = \frac{100 \times 6.5％}{112} = 6.5％$，$r_f = 4％$，$T = 40％$。

$r_{WACC} = \frac{S_1}{V} \times r_s + \frac{S_2}{V} \times r_f + \frac{B_1}{V} \times r_B (1-T) + \frac{B_2}{V} \times r_B (1-T)$

$V = S_1 + S_2 + B_1 + B_2$

$r_{WACC} = 9.81％$

公司債1: 50,000 口，面額: $1,000，年利率: 8.00％，報價: $119.80
公司債2: 150,000 口，面額: $1,000，年利率: 0.00％，報價: $13.85
特別股: 120,000 股，面額: $100，股利: 6.50％，市價: $112.00
普通股: 2,000,000 股，市價: $65，β = 1.1，n1 = 50
$r_M - r_f = 9％$，$r_f = 4％$，$T = 40％$，$n2 = 60$

$r_{WACC} = 9.81％$
第 6 题 WACC and NPV （第 12 章，#16，365 頁。）

Photochronograph Corporation (PC) manufactures time series photographic equipment. It is currently at its target debt-equity ratio of 1.3. It’s considering building a new ¥45 million manufacturing facility. This new plant is expected to generate after tax cash flows of ¥5.7 million in perpetuity. There are three financing options:

• *A new issue of common stock.* The required return on the company’s equity is 17 percent.
• *A new issue of 20-year bonds.* If the company issues these new bonds at an annual coupon rate of 9 percent, they will sell at par.
• *Increased use of accounts payable financing.* Because this financing is part of the company’s ongoing daily business, the company assigns it a cost that is the same as the overall firm WACC. Management has a target ratio of accounts payable to long-term debt of .20. (Assume there is no difference between the pretax and after tax accounts payable cost.)

What is the NPV of the new plant? Assume that PC has a 35 percent tax rate.

【分析】
新投資案投資金額$45,000,000，可永續創造每年$5,700,000 稅後現金流量。

\[ NPV = -45,000,000 + \frac{5,700,000}{r_{WACC}} \]

重點是如何估算 \( r_{WACC} \)。

題意要我們由三個資金來源估算：普通股 S、公司債 B1、應付帳款（短期負債）B2

資料：
- \( D/E = 1.3 \)
- \( r_S = 17\% \)
- \( r_B = 9\% \)
- \( r_{WACC} = \frac{S}{V} \times r_S + \frac{B_1}{V} \times r_B + \frac{B_2}{V} \times (1 - T) \)
- \( B_2 / B_1 = 0.2 \)
- \( T = 35\% \)

\[
\begin{align*}
\frac{S}{V} &= 0.4348 \\
\frac{B_1}{V} &= 0.4710 \\
\frac{B_2}{V} &= 0.0942 \\
\frac{D}{E} &= 1.3 \\
\frac{B_2}{B_1} &= 0.2 \\
P_0 &= 45,000,000 \\
A &= 5,700,000 \\
r_S &= 17\% \\
r_B &= 9\% \\
T &= 35\% \\
S/V &= 0.4348 \\
B_1/V &= 0.4710 \\
B_2/V &= 0.0942 \\
a &= 10.15\% \\
b &= 0.0942 \\
r_{WACC} &= 11.20\% \\
NPV &= 5,883,771
\end{align*}
\]