FM 2555A
Assignment No. 2
Due Date: <u>12:30</u>, 10 November 2016
BGS 165

NOTE: Only solutions to **5** problems marked with ♣ (see pages 7-8) are required for submission. The other problems are practice exercises.

GUIDELINES ON SUBMITTING ASSIGNMENTS

- **Your assignment paper must include the Marking Scheme as a cover page.** This marking scheme can be downloaded from the course website. *Failure to follow this instruction can result to a 2-point deduction on your assignment mark.*

- Do not submit your rough work! Do the problem set and then re-write it at least once - neatly, with adequate amount of clear explanation. The rewriting stage is the most important one for finding errors in one's work, and it will also deepen your understanding of the subject matter. Assignments are marked for both technical correctness and elegance of presentation.

- Bear in mind to include a sufficient amount of explanation about your work so that any marker does not have to guess what you mean. The grader of your work will determine if you understand what you are writing, not merely that you reach the particular correct answer.

- On questions where a computer output is required, include the output in the text of your answer at the appropriate locations - do not put it all in a bunch at the end of your assignment. Unless, you are instructed to submit your work in a CD or disc, you are expected to hand in a PRINTED COPY. *Assignments sent via e-mail will not be accepted.*

- YOU MUST WRITE YOUR OWN WORK IN YOUR OWN WORDS, using full sentences and proper English grammar. It is your responsibility to familiarise yourself with the provisions of the University Regulation concerning academic integrity and honesty. *Any behaviour that can potentially lead to plagiarism and cheating (including copying from/sharing with another student answers in assignments and exams) is a serious offence and carries with it severe penalty.*

Problems below, unless indicated otherwise, were taken from Brealey, R. (2017), Principles of Corporate Finance, 12ᵗʰ edition, McGraw-Hill Education, New York.
N.B.: *For problems not required for submission, you will learn and benefit more if you attempt solving them first before looking at their solutions.*

NOTE: Problem number format: [x/y], where x is the number of the problem and y is the page number in the 12ᵗʰ ed of the Brealey et al. textbook.

Problem [1/125]
a. What is the payback period on each of the following projects?

	Cash Flows ($)				
Project	C_0	C_1	C_2	C_3	C_4
A	-5,000	+1,000	+1,000	+3,000	0
B	-1,000	0	+1,000	+2,000	+3,000
C	-5,000	+1,000	+1,000	+3,000	+5,000

b. Given that you wish to use the payback rule with a cutoff period of two years, which projects would you accept?
c. If you use a cutoff period of three years, which projects would you accept?
d. If the opportunity cost of capital is 10%, which projects have positive NPVs?
e. "If a firm uses a single cutoff period for all projects, it is likely to accept too many short-lived projects." True or false?
f. If the firm uses the discounted-payback rule, will it accept any negative-NPV projects? Explain.

Problem [2/125]
Write down the equation defining a project's internal rate of return (IRR). In practice how is IRR calculated?

Problem [3/125]
a. Calculate the net present value of the following project for discount rates of 0, 50, and 100%?

Cash Flows ($)		
C_0	C_1	C_2
-6,750	+4,500	+18,000

b. What is the IRR of the project?

Problem [4/125]

You have the chance to participate in a project that produces the following cash flows.

Cash Flows ($)		
C_0	C_1	C_2
+5,000	+4,000	-11,000

The IRR is 13%. If the opportunity cost of capital is 10%, would you accept the offer?

Problem [5/126]

Consider a project with the following cash flows:

Cash Flows ($)		
C_0	C_1	C_2
-100	+200	-75

a. How many IRRs does this project have?
b. Which of the following numbers is the project IRR:
    (i) -50%   (ii) -12%   (iii) +12%   (iv) +50%?
c. The opportunity cost of capital is 20%. Is this an attractive project? Briefly explain.

Problem [7/126]

Suppose you have the following investment opportunities, but only $90,000 available for investment. Which projects should you take?

Project	NPV	Investment
1	5,000	10,000
2	5,000	5,000
3	10,000	90,000
4	15,000	60,000
5	15,000	75,000
6	3,000	15,000

Problem [10/127]

Calculate the IRR(s) for the following project:

C_0	C_1	C_2	C_3
-3,000	+3,500	+4,000	-4,000

For what range of discount rates does the project have positive NPV?

Problem [2/152]

Mr Art Deco will be paid $100,000 one year hence. This is a nominal flow, which he discounts at an 8% nominal discount rate:
$$PV = 100,000/1.08 = \$92, 593.$$
The inflation rate is 4%. Calculate the PV of Mr Deco's payment using the equivalent *real* cash flow and *real* discount rate. (You should get exactly the same answer as he did.)

Problem [7/153]

Air conditioning for a college dormitory will cost $1.5 million to install and $200,000 per year to operate. The system should last 25 years. The real cost of capital is 5%, and the college pays no taxes. What is the equivalent annual cost?

Problem [8/153]

Machines A and B are mutually exclusive and are expected to produce the following real cash flows:

Cash Flows ($ thousands)				
Machine	C_0	C_1	C_2	C_3
A	-100	+110	+121	
B	-120	+110	+121	+133

The real opportunity cost of capital is 10%.
a. Calculate the NPV of each machine.
b. Calculate the equivalent annual cash flow from each machine.
c. Which machine should you buy?

Problem [9/153]

Machine C was purchased five years ago for $200,000 and produces an annual real cash flow of $80,000. It has no salvage value but is expected to last another five years. The company can replace machine C with machine B (see Problem 8/153) *either* now *or* at the end of five years. What should it do?

Problem [11/153]

CSC is evaluating a new project to produce encapsulators. The initial investment in plant and equipment is $500,000. Sales of encapsulators in year 1 are forecasted at $200,000 and costs at $100,000. Both are expected to increase by 10% a year in line with inflation.

Profits are taxed at 35%. Working capital in each year (starting at $40,000) consists of inventories of raw materials and is forecasted at 20% of sales in the following year.

The project will last five years and the equipment can be depreciated straight-line over these five years. If the nominal discount rate is 15%, show that the net present value of the project is the same whether calculated using real cash flows or nominal cash flows.

Problem [14/154]
Ms T Potts, the treasurer of Ideal China, has a problem. The company has just ordered a new kiln for $400,000. Of this sum, $50,000 is described by the supplier as an installation cost. Ms Potts does not know whether the Internal Revenue Service (IRS) will permit the company to treat this cost as a tax-deductible current expense or as a capital investment. In the latter case, the company could depreciate the $50,000 using the five-year MACRS tax depreciation schedule. How will the IRS's decision affect the after-tax cost of the kiln? The tax rate is 35% and the opportunity cost of capital is 5%.

Problem [16/154]
A project requires an initial investment of $100,000 and is expected to produce a cash inflow before tax of $26,000 per year for five years. Company A has substantial accumulated tax losses and is unlikely to pay taxes in the foreseeable future. Company B pays corporate taxes at a rate of 35% and can depreciate the investment for tax purposes using the five-year MACRS tax depreciation schedule. Suppose the opportunity cost of capital is 8%. Ignore inflation.
a. Calculate the project NPV for each company.
b. What is the IRR of the after-tax cash flows for each company? What does comparison of the comparison of the IRRs suggest is the effective corporate tax rate?

Problem [1/186]
A game of chance offers the following odds and payoffs. Each play of the game costs $100, so the net profit per play is the payoff less $100.

Probability	Payoff	Net Profit
0.10	$500	$400
0.50	100	0
0.40	0	-100

What are the expected cash payoff and expected rate of return? Calculate the variance and standard deviation of this rate of return

Problem [2/186]
The following table shows the nominal returns on the US stocks and the rate of inflation.
a. What was the standard deviation of the nominal returns?

b. Calculate the arithmetic average real return.

Year	*Nominal Return (%)*	*Inflation (%)*
2010	17.2	1.5
2011	1.0	3.0
2012	16.1	1.7
2013	33.1	1.5
2014	12.7	0.8

Problem [3/187]

During the boom years of 2010-2014, ace mutual fund manager Diana Sauros produced the following percentage rates of return. Rates of return on the market are given for comparison.

	C_0	C_1	C_2	C_3	C_4
Ms Sauros	+24.9	-0.9	+18.6	+42.1	+15.2
S&P 500	+17.2	+1.0	+16.1	+33.1	+12.7

Calculate the average return and standard deviation of Ms Sauro's mutual fund. Did she do better or worse than the market by these measures?

Problem [6/187]

To calculate the variance of a three-stock portfolio, you need to add nine boxes:

Use the same symbols that we used in the class; for example, x_1 = proportion invested in stock 1 and σ_{12} = covariance between stocks 1 and 2. Now complete the nine boxes.

Problem [8/188]

A portfolio contains equal investments in 10 stocks. Five have a beta of 1.2; the remainder have a beta of 1.4. What is the portfolio beta?
a. 1.3
b. Greater than 1.3 because the portfolio is not completely diversified.
c. Less than 1.3 because diversification reduces beta.

Problem [10/188]

Here are the inflation rates and US stock market and Treasury bill returns between 1929 and 1933:

Year	Inflation	Stock Market Return	T-Bill Return
1929	-0.2	-14.5	4.8

1930	-6.0	-28.3	2.4
1931	-9.5	-43.9	1.1
1932	-10.3	-9.9	1.0
1933	0.5	57.3	0.3

a. What was the real return on the stock market in each year?
b. What was the arithmetic average real return?
c. What was the risk premium in each year?
d. What was the average risk premium?
e. What was the standard deviation of the risk premium?

Problem [13/188]
Lonesome Gulch Mines has a standard deviation of 42% per year and a beta of +0.10.
Amalgamated Cooper has a standard deviation of 31% a year and a beta of +0.66.
Explain why Lonesome Gulch is the safer investment for a diversified investor.

Problem [19/189]
There are few, if any, real companies with negative betas. But suppose you found one
with beta = -0.25.
a. How would you expect this stock's rate of return to change if the overall market rose
   by an extra 5%? What if the market fell by an extra 5%?
b. You have $1 million in a well-diversified portfolio of stocks. Now you receive an
   additional $20,000 bequest. Which of the following actions will yield the safest overall
   portfolio return?
   i. Invest $20,000 in Treasury bills (which have beta = 0).
   ii. Invest $20,000 in stocks with beta = 1.
   iii. Invest $20,000 in the stocks with beta = -0.25.

♣ Required Assignment Question 1 (Not from the textbook) [4 points]
Dry-Sand Co. is considering investing in a new project. The project will need an initial
capital investment of $1.2 million and generate $600K (after-tax) cash flows for three
years. However, at the end of the 4th year, the project will generate-$500K of after-tax
cash flow due to dismantling costs. Calculate the MIRR (modified IRR) for the project if
the cost of capital is 15%. [**N.B**: You may use Excel or a Financial Calculator to check
your answer. However, you need to demonstrate what equation you are solving including
all the steps necessary to arrive at such an equation, and you must also define all
variables/notation you are using.]

♣ Required Assignment Question 2 (Not from the textbook) [4 points]
Rainman Inc is in the business of producing rain upon request. Rainman's CFO must
decide between 2 investment projects: a new airplane for seeding rain clouds or a new

weather control machine built by Dr Nutzbum. The discount rate for the new airplane is 9% whilst the discount rate for the new weather machine is 39% (it happens to have higher market risk). Assume a 0% inflation rate and that the projected costs do not change over time. The cash flows (in $10,000) for each investment are given below.

Year	Airplane	Weather Machine
1	-900	-900
2	500	550
3	600	600
4		685

Which investment should the company select and why?

♣Required Assignment Question 3 (Not from the textbook) [4 points]

 A project requires an initial investment of $200K and expects to produce a cash flow before taxes of $120K per year for two years (i.e., cash flows will occur at $t = 1$ & $t = 2$). The corporate tax rate is 30%. The asset will depreciate using the MACRS year-3 schedule [t=1: 33%]; [t=2: 45%]; [t=3: 15%]; [t=4: 7%]. The company's tax situation is such that it can use all applicable tax shields. The opportunity cost of capital is 11%. Calculate IIR for the project. [**N.B:** Do not use Excel or a Functional Calculator for this question. You must solve explicitly the corresponding quadratic equation; otherwise you lose marks for not including an illustration of how to solve such an equation.]

♣Required Assignment Question 4 (Problem [21/190]) [4 points]

Here are some historical data on the risk characteristics of Bank of America and Starbucks:

	Bank of America	Starbucks
Beta	1.57	0.83
Yearly standard deviation of return (%)	35.80	21.00

Assume the standard deviation of the return on the market was 23.0%.

a. The correlation coefficient of Bank of America's return versus Starbucks is 0.30. What is the standard deviation of a portfolio invested half in each share? [1 pt]

b. What is the standard deviation of a portfolio invested one-third in Bank of America, one-third in Starbucks, and one-third in risk-free Treasury bills? [1 pt]

c. **What is the standard deviation if the portfolio is split evenly between Bank of America and Starbucks and is financed at 50% margin, that is, the investor puts up only 50% of the total amount and borrows the balance from the broker? [1 pt]**

d. **What is the *approximate* standard deviation of a portfolio composed of 100 stocks with betas of 1.57 like Bank of America? How about 100 stocks like Starbucks? [1 pt]**

♣ Required Assignment Question 5 (Problem [22/190]) [4 points]

Suppose that Treasury bills offer a return of about 6% and the expected market risk premium is 8.5%. The standard deviation of Treasury-bill returns is zero and the standard deviation of market returns is 20%. Use the formula for portfolio risk to calculate the standard deviation of portfolios with different proportions in Treasury bills and the market. (*Note:* The covariance of two rates of return must be zero when the standard deviation of one return is zero.) Graph the expected returns and standard deviations.