UNIVERSITÉ Concordia UNIVERSITY

Examination Cover Sheet

Print Name: ➔		**ID Number:** ➔	
COURSE FINANCE	**NUMBER** COMM 308	**SECTIONS: (➔ Circle your section)** A, AA, B, BB, C, D, E, F	
EXAMINATION Final Exam **VERSION BLUE**	**DATE** December 11, 2014	**TIME** 3 hours 19:00 to 22:00	**# OF PAGES 19** Including this cover
INSTRUCTOR: **(➔ Underline your instructor's name)** Jennifer Yang — Nabil El Meslmani Kaveh Moradi Dezfouli — Monir Wahhab Ian Rakita — Ahmed Eissa Rahul Ravi		**DIVISION** John Molson School of Business Concordia University	

INSTRUCTIONS: Please read these carefully

1. **Please ensure you have 19 pages (including this cover page) in this exam.**
2. **For Part I of this exam (Multiple Choice Questions): All answers must be recorded IN PENCIL on the computer sheet. Only the computer sheet will be graded.**
3. **For Part II: Show your calculations to earn part marks. Write in the space provided. If you are using the back of the exam for answering any question, you should label it clearly**
4. **For Part II: All answers must be recorded IN INK within this exam.**

MATERIALS ALLOWED:

1. **You must submit a BLUE computer answer sheet.**
2. **You are allowed to bring one or more calculators (ENCS sticker not necessary)**
3. **You are allowed to bring one language dictionary (no finance/ mathematics/economics etc. dictionary)**

SCORES (FOR INTERNAL USE ONLY)

Part I MCQ	**Part II Numerical and Short Answer Questions**				
	Question 1	Question 2	Question 3	Question 4	
(Max: 70 Points)	(Max: 10 Points)	(Max: 5 Points)	(Max: 10 Points)	(Max: 5 Points)	**Total**

Part I: Multiple Choice Questions (28 Questions, 70 Points Total):

- This part consists of 28 Multiple Choice Questions. Each question is worth 2.5 points.
  - **Only answers on the computer answer sheet will be graded.**
  - **Use a pencil to mark your answers on the Computer Sheet.**

1. Your company is planning to borrow $500,000 on a 25-year, 7 percent, annual payments, fully amortized term loan. What fraction of the payment made at the end of the eleventh year will represent repayment of principal?

   A. 76.29%

   B. 63.76%

   C. 36.25%

   D. 23.71%

   E. None of the above

$500{,}000 = \frac{P}{0.07} \times \left[1 - \frac{1}{1.07^{25}}\right]$

$P = \$42905.26$

$OLB_{10} = \frac{42905.26}{0.07} \times \left[1 - \frac{1}{1.07^{15}}\right] = \$390777.41$

$Interest(11) = 0.07 \times OLB_{10} = \$27354.42$

% of P(11) towards principal: $1 - \frac{27354.42}{42905.26} = 36.25\%$

2. You plan to buy a new HDTV. The dealer offers to sell the set to you on credit. You will have 3 months in which to pay, but the dealer says you will be charged a 15 percent interest rate; that is, the nominal rate is 15 percent, semi-annual compounding. As an alternative to buying on credit, you can borrow the funds from your bank. At what nominal bank interest rate (APR compounded monthly) should you be indifferent between the two types of credit? Use at least 6 decimal places in your calculations for this question.

   A. 12.000%

   B. 14.000%

   C. 14.520%

   D. 14.551%

   E. 14.600%

BR: 15% APR with semi-annual compounding.

Eff. Monthly Rate $= \left(1 + \frac{0.15}{2}\right)^{1/6} - 1 = 1.2126\%$

APR Comp. monthly = 14.5512%

3. If a market is not weak form efficient then the correlation coefficient between stock returns for two non-overlapping time periods should be:

   A. Positive

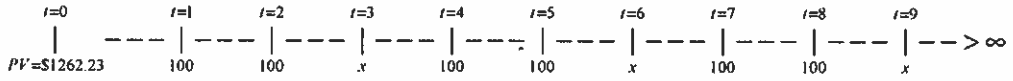
   B. Negative

   C. Zero

   D. Either negative or positive, but not zero

   E. Either negative, positive, or zero

4. The present value (t = 0) of the following cash flow stream is $1,262.23 when discounted at 12 percent (EAR). What is the value of the missing cash flows (x)? Assume the pattern of payments continues in perpetuity.



A. $51.47

B. $173.67

C. $273.67

D. $300.00

E. None of the above

$1262.23 = \frac{100}{0.12} + \frac{x-100}{\text{Eff. 3 year rate}}$

Eff. 3 year rate $= 1.12^3 - 1 = 0.404928$

$\therefore x - 100 = \left[1262.23 - \frac{100}{0.12}\right] \times 0.404928$

$= 173.67 \Rightarrow x = \$273.67$

5. Which one of the following is true concerning amortized loans?

A. A loan where **annual** payment includes a part of the principal plus a fraction of the interest due.

B. A loan where **annual** payment includes all the interest due plus a fraction of the principal.

C. A loan where **monthly** payment includes all the interest due plus a fraction of the principal.

D. Both B and C, but not A

E. A, B, and C are correct.

6. Given the following information, which investment(s) would risk averse investors prefer if the risk free rate is 5 percent?

		Value of Investment after one year:	
Investment	Cost Today	Probability: 40%	Probability: 60%
I	$18	$36	$8
II	$14	$12	$16
III	$15	$30	$5

$E(P_1)$	$E(R)$
19.2	6.67%
14.4	2.86%
15	0

A. I only $\quad E(R_I) = 6.67\% > 5\%$

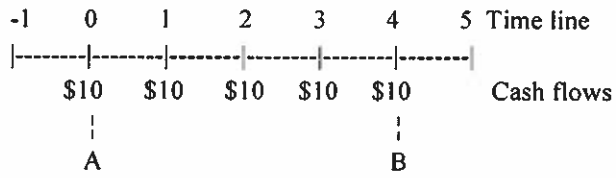
B. II only

C. III only

D. I and II only

E. I and III only

7. Study the time line and accompanying 5-period cash-flow pattern below.



The present value of the cashflows at Point A is the present value of a 5-period _____, whereas the future value at Point B is the future value of a 5-period _____ .

A. ordinary annuity starting at -1; ordinary annuity starting at -1.

B. annuity due starting 0; annuity due starting at 0.

C. annuity due starting at 0; ordinary annuity starting at -1.

D. ordinary annuity starting at -1; annuity due starting at 0.

E. None of the above.

8. A new project with a life of 10 years, costs $210,000 and is expected to generates annual net cash inflows of $x each year. The project has a discounted payback period of 9 years. Which of the following statement/s is/are most correct: (*Note: RRR stands for the required rate of return for the project*)

A. $NPV_A>0$, and $PI_A>1$

B. $IRR_A>RRR_A$, and Payback period will be less than 10 years

C. $PI_A<1$, and $IRR_A> RRR_A$

D. Both A and B

E. Both B and C

9. In considering capital budgeting for a project being evaluated by a corporation:

A. the second year CCA tax shield (CCA rate = 20% and the corporation's income tax rate = 25%) for a $40,000 asset acquired for the project is $1,800.

B. the real interest rate is 8%, the inflation rate is 2%, and all cash flows are estimated in real amounts, the appropriate discount rate to determine the project's NPV is 10.16%.

C. the corporate tax rate is not related to the amount in the UCC account

D. A and C are correct

E. A, B, and C are correct

	UCC	CCA	UCC	TS
			36000	1000
1	40,000	4000		
2	36,000	7200	28,800	1800

10. A _____ can lose, at most, what she has already invested.

I. common stockholder
II. preferred shareholder
III. short position in call option
IV. long position in put option

A. I only

B. I and II only

C. I, II, and IV only

D. II, III, and IV only

E. II and III only

11. A particular asset has a beta of 0.61 and an expected return of 10%. The expected return on the market portfolio is 13% and the risk-free is 5%. Which of the following statement is correct?

A. This asset is correctly priced according to the CAPM because its returns lie on the SML.

B. This asset is underpriced according to the CAPM because its returns lie above the SML.

C. This asset is overpriced according to the CAPM because its returns lie above the SML.

D. This asset is overpriced according to the CAPM because its returns lie below the SML

E. This asset is underpriced according to the CAPM because its returns lie below the SML.

(CAPM: $0.05 + 0.61 \times (0.13 - 0.05) = 9.88\% < 10\%$

12. Which of the following statement/s is most correct?

A. Assume that the required rate of return on a given stock is 13%. If the stock's dividend is expected to grow (in perpetuity) at a constant rate of 5%, its expected dividend yield will be more than 5%.

B. The dividend yield on a stock is equal to the realized return less the capital gain.

C. A stock's capital gain can never be equal to the dividend growth rate

D. Answers A and B are correct.

E. Answers A, B, and C are correct.

13. Given no change in required returns, the price of a stock whose dividend is constant will: (Assume the required rate of return for the stock is k% EAR)

A. Increase over time at a rate of k%.

B. Decrease over time at a rate of k%.

C. Increase over time at a constant rate, which may be different from k%.

D. Decrease over time at a constant rate, which may be different from k%.

E. None of the above.

14. With the half year rule, the depreciation percentage is lower in the first year than it is in the second year. This is due to the fact that:

A. The depreciation percentage increases in each year.

B. Assets are assumed to be acquired at mid-year.

C. Depreciation expense increases at the rate of inflation.

D. It is a CCA rule set forward by revenue authorities without any reason.

E. None of the above.

15. A ten-year zero coupon bond with a face value of $1,000 is currently priced at 48.72% of the face value. Assume the bond's YTM remains unchanged throughout the bond's term to maturity. What should the bond be sold for three years from now?

A. $487.20

B. $594.19

C. $604.50

D. $805.96

E. None of the above.

$P_0 = \$487.2 = \frac{1000}{(1+r)^{10}}$

$\therefore r = \left(\frac{1000}{487.2}\right)^{1/10} - 1 = 7.4557\%$

$P_3 = \frac{1000}{(1.074557)^7} = \$604.50$

16. If markets were semi-strong form efficient, which of the following situations would potentially yield abnormal returns?

A. Analyzing a company's earnings report

B. Identifying a pattern in a company's stock price

C. Obtaining insider information

D. All of the above would yield abnormal returns

E. None of the above

17. Your uncle would like to limit his interest rate risk and his default risk, but he would still like to invest in corporate bonds. Which of the possible bonds listed below best satisfies your uncle's criteria?

A. A AAA-rated 5% coupon bond with 10 years to maturity.
B. A AAA-rated 5% coupon bond with 5 years to maturity.
C. A BBB-rated 5% coupon bond with 10 years to maturity.
D. A zero coupon bond with 5 years to maturity
E. Unable to answer because of insufficient information in choice (D)

18. Suppose Sarah can borrow and lend at the risk free-rate of 3%. Assume Sarah is risk averse. Which of the following four risky portfolios should she hold in combination with a position in the risk-free asset?

SR

A. portfolio with a standard deviation of 15% and an expected return of 12% 0.6
B. portfolio with a standard deviation of 19% and an expected return of 15% 0.632
C. portfolio with a standard deviation of 25% and an expected return of 18% 0.6
D. portfolio with a standard deviation of 12% and an expected return of 9% 0.5
E. Insufficient information.

* Alternate solution on next page.

19. The investment firms which act as intermediaries between the issuer of securities and the general public are called:

A. underwriters
B. investment advisors
C. brokers
D. Green Shoe firms
E. red herrings

20. The Bud Wise Co. needs to raise $125 million to expand their operations into Asia. The company will sell new shares of common stock via general cash offering to raise the necessary funds. The underwriters charge a 7.5 percent spread and the administrative costs are $600,000. How many shares of stock must be sold at the offer price of $31?

A. 4,190,909 shares
B. 4,209,707 shares
C. 4,359,198 shares
D. 4,380,122 shares
E. 4,414,141 shares

Let the number of shares be x.

$(1-0.075) \times 31x = 125{,}000{,}000 + 600{,}000$

$x \cong 4380122$

* Solving Q 18 without the use of Sharpe ratio:

	Risk	Ret-
A	15%	12%
B	19%	15%
C	25%	18%
D	12%	9%

$r_f = 3\%$.

Compare A & B: Combine B & r_f to build a portfolio with

$$\text{Risk} = \sigma_P = 0.15$$

$$\omega \times 0.19 = 0.15 \Rightarrow \omega = 15/19$$

$$\therefore 1-\omega = 4/19$$

$$\text{Return of this portfolio} = \frac{15}{19} \times 0.15 + \frac{4}{19} \times 0.03 = 12.47\% > 12\%.$$

$\therefore$ Asset B is better than asset A.

Compare B with C: Combine B & r_f to build a portfolio with

$$\text{Risk} = \sigma_P = 0.25$$

$$\omega \times 0.19 = 0.25 \Rightarrow \omega = 25/19$$

$$\therefore 1-\omega = -6/19$$

$$\text{Return of this portfolio} = \frac{25}{19} \times 0.15 - \frac{6}{19} \times 0.03 = 18.789\% > 18\%.$$

$\therefore$ Asset B is better than asset C

Compare B with D: Combine B & r_f to build a portfolio with

$$\text{Risk} = \sigma_P = 0.12$$

$$\omega \times 0.19 = 0.12 \Rightarrow \omega = 12/19 \qquad 1-\omega = 7/19$$

$$E(r_p) = \frac{12}{19} \times 0.15 + \frac{7}{19} \times 0.03 = 10.58\% > 9\%$$

$\therefore$ Asset B is better than asset D

21. An analyst has obtained the following information about the Velo Co.: Book value of assets $25,000; book value of common equity $10,000; book value of preferred stock $5,000. The company has 4,000 common shares outstanding which are currently trading at $5 per share. The company has 3,000 preferred shares outstanding which are currently trading at $2 per share. The yield on the debt equals the coupon rate. The weights used to determine the weighted average cost of capital are:

	Common Equity	Preferred Equity:	Debt:
(A.)	55.56% ;	16.67% ;	27.78%
B.	40.00% ;	20.00% ;	40.00%
C.	23.52% ;	17.65% ;	58.82%
D.	33.33%;	33.33%;	33.33%
E.	Cannot be determined, we need the market value of debt		

$MV_{equity} = \$20,000$

$MV_{pref} = \$6,000$

$MV_{debt} = 25,000 - 10,000 - 5,000$

$= 10,000$

$\therefore V = 20,000 + 6000 + 10,000 = \$36,000$

22. The value of a call option:

A. Increases as the price fluctuation of the underlying security decreases.

(B.) Increases as the exercise price decreases.

C. Increases as the time to expiration decreases.

D. Increases as the risk-free rate of return decreases.

E. None of the above.

23. If a stock's beta is 0.8 during a period when the market portfolio was down by 10%, then, we could expect the return on this individual stock to: *(ceteris paribus)*

A. lose exactly 10%

B. gain more than 10%

(C.) lose less than 10%

D. gain exactly 10%

E. The average level of mispricing in the market

$E(r) = r_f + \beta \times (E(r_m) - r_f)$

24. You are offered an investment opportunity with the "guarantee" that your investment will double in 5 years. What monthly rate of return would this investment provide?

A. 40.00%

B. 100.00%

C. 14.87%

D. 20.00%

(E.) None of the above

$2x = x \times (1+r)^{60}$

$r = 2^{1/60} - 1 = 1.162\%$

25. McCarver Inc. is considering the following mutually exclusive projects:

Year	Project A Cash Flow	Project B Cash Flow
0	-$5,000	-$5,000
1	200	3,000
2	800	800
3	200	200
4	5,000	200

A - B

0
-2300
0
0
4800

At what cost of capital will the net present value (NPV) of the two projects be the same?

A. 0%

B. 14.43%

C. 19.68%

D. 30.93%

E. None of the above

Crossover rate: r

$$\frac{-2300}{1+r} + \frac{4800}{(1+r)^4} = 0$$

$r = 19.68\%$

26. The table below shows how an asset purchased for $40,000 and belonging to an asset class with a 20% CCA rate is depreciated over time for tax purposes:

Year	UCCB	CCA	UCCE
1	$40,000.00	$4,000.00	$36,000.00
2	$36,000.00	$7,200.00	$28,800.00
3	$28,800.00	$5,760.00	$23,040.00

Suppose the asset is sold for $26,000 after three years and the asset pool is terminated. As a result of this:

A. Firm must pay CCA recapture on $2960

B. $23,040 must be removed (deducted) from the asset pool.

C. $26,000 must be removed (deducted) from the asset pool.

D. Both A and B are correct.

E. Both A and C are correct.

27. Which of the following would be considered relevant cash flows in a capital budgeting evaluation?

I. Tax savings due to increased depreciation expense.
II. Increased expenditures on inventory for the new project.
III. Cost of the feasibility survey which was conducted two months ago.

A) I only
B) I and II.
C) I and III.
D) II and III
E) I, II and III

28. Braun Industries is considering an investment project that has the following cash flows:

Year	Cash Flow
0	-$1,000
1	400
2	300
3	500
4	400

The company's WACC is 10 percent. What is the project's Internal rate of return (IRR), discounted payback, and net present value (NPV)? *(Choose the closest response)*

A. IRR = 10.00%, Discounted Payback = 2.60, NPV = $600
B. IRR = 21.22%, Discounted Payback = 3.05, NPV = $300
C. IRR = 21.22%, Discounted Payback = 2.60, NPV = $260
D. IRR = 21.22%, Discounted Payback = 3.05, NPV = $260
E. None of the above.

Year	CF	PV(CF)	Cumulative
0	-1000	-1000	-1000
1	400	367.64	-636.36
2	300	247.93	-388.43
3	500	375.66	-12.77
4	400	273.21	$\frac{12.77}{273.21} = 0.05$
		260.44	

∴ Discounted payback period = 3.05 years.

Part II: Problems (30 Points Total)

- Answer on this document, in the space provided. Use the back of the sheet if you need additional space. Label it clearly. Any work on the back of the sheet, which is not labeled clearly, will not be graded.
- Show all your work. Unsupported statements or numbers will not receive any credit.

Q1. **(8 Points) Application of TVM:** This question has two unrelated parts. Information from part (a) should not be used in part (b)

Q1 (Part a) (3 Points): Assume x>0 and that the discount rate is positive. You have been asked to analyze an investment with the following cash flows:

Time	0	1	2	3
Cash Flow		-(x+1)	-x	2x

Is this investment acceptable? Why or why not? *(You do not need to make any calculation, but only provide the logic behind your answer)*

For discount rate $r = 0$

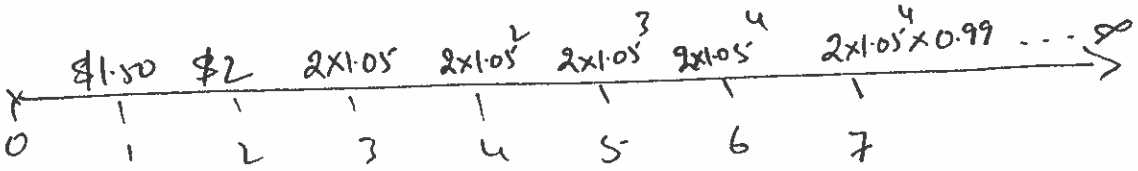
$PV_0 = -x - 1 - x + 2x = -1 < 0$

For higher discount rate the PV_0 will further decrease.

∴ This is a -ve NPV project and it should not be accepted.

Q1 (Part b) (5 Points): A company is expected to pay a dividend of $1.50 at the end of this year, and $2.00 dividend at the end of year 2. Thereafter, it is estimated that dividends will grow at a constant rate of 5% per year for next 4 years and then start declining at a constant rate of 1% in perpetuity. Investors require a return of 10%.

Given the above information, what is the current market value of this company's common stock?



$r = 10\%$

$$P_6 = \frac{2 \times 1.05^4 \times 0.99}{0.1 + 0.01} = 21.879$$

present value of 5-period growing annuity

$$P_1^{Ann} = \frac{2}{0.1 - 0.05} \times \left[1 - \left(\frac{1.05}{1.1}\right)^5\right] = \$8.3012$$

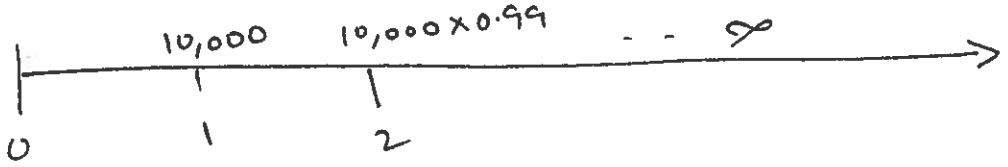
$$P_0 = \frac{1.50 + 8.3012}{1.1} + \frac{21.879}{1.1^6}$$

$$= \$21.26$$

Q2. (5 Points):

You are considering acquiring a firm that you believe can generate expected cash-flow of $10,000 next year and after that the cash-flows will decline at a constant rate of 1% per year for ever. However, you recognize that those cash flows are uncertain. You expect that the beta of the firm is 0.4. How much is the firm worth?

The risk free rate is 5% and the expected rate of return on the market portfolio is 15%.



$\beta = 0.4 \qquad r_f = 5\% \qquad E(r_m) = 0.15$

Using CAPM: $E(r) = 0.05 + 0.4 \times (0.15 - 0.05)$

$= 0.09 = 9\%$

$PV_0 = \dfrac{10,000}{0.09 + 0.01} = \$100,000$

Q3. **(12 Points)** This question has two unrelated parts. Information from part (a) should not be used in part (b)

Question 3, Part a) (5 Points): Cost of Capital

WidgetsRus is considering a new project they consider to be a little riskier than their current operations. Thus, management has decided to add an additional 2.5 percent to their company's overall cost of capital when evaluating this project. The project has an initial cash outlay of $30,000 and projected cash inflows of $12,000 in year one, $20,000 in year two, and $8,000 in year three. The firm uses 40 percent debt and 60 percent common stock as their capital structure. The company's cost of equity is 14 percent while the after-tax cost of debt for the firm is 7 percent. What is the projected net present value of the new project?

$$WACC_{firm} = 0.6 \times 0.14 + 0.4 \times 0.07$$

$$= 11.2\%$$

$$WACC_{project} = 11.2\% + 2.5\% = 13.7\%$$

$$NPV_{project} = -30{,}000 + \frac{12{,}000}{1.137^1} + \frac{20{,}000}{1.137^2} + \frac{8000}{1.137^3}$$

$$= \$1467.38$$

Question 3, Part b) (7 Points): Capital Budgeting

A senior executive is considering replacing one of the junior executives with a Honda Asimo robot that is capable of recognizing faces and gestures, as well as being able to walk and even climb stairs. She figures that she could argue strongly to the board that such "capital deepening" is necessary for the cost-conscious firm. Two days later, a feasibility study is completed, and the following data are presented to the president:

- It would cost $300,000 to purchase a robot with a life expectancy of 20 years at which its salvage value will be zero.
- Annual expenses of using the robot would be $100,000.
- The junior executive's annual salary is $150,000.
- The cost of the robot will be placed in class 8 with a CCA rate of 20%.
- The firm's marginal tax rate is 40%.
- The firm's current cost of capital is estimated at 11%.

On the basis of net present value criterion, should the robot be used (and the junior executive fired)?

Annual after tax saving of Robot compared to executive

$$= (150{,}000 - 100{,}000)(1 - 0.4)$$

$$= \$30{,}000$$

$$PV_0(\text{After tax saving}) = \frac{30{,}000}{0.11} \times \left[1 - \frac{1}{1.11^{20}}\right]$$

$$= \$238{,}899.84$$

$$NPV(\text{Excluding CCA tax shield}) = -300{,}000 + 238{,}899.84$$

$$= -61{,}100.16$$

$$PV(\text{CCATS}) = \frac{300{,}000 \times 0.2 \times 0.4}{0.2 + 0.11} \times \frac{1 + 0.5 \times 0.11}{1.11} = \$73583.26$$

$\therefore NPV = \$12{,}483.10$

Decison : Replace the executive with Robot.

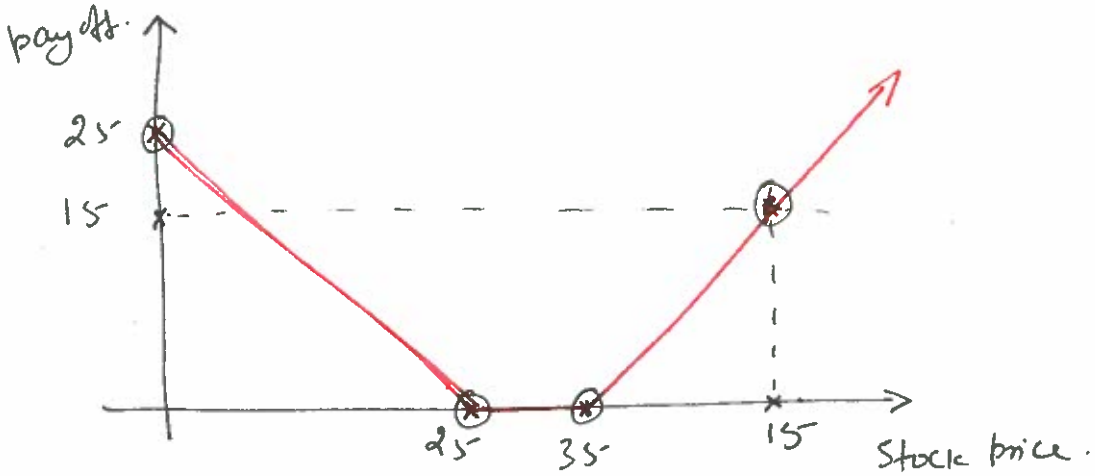
Q4. **(5 Points) Option portfolio payoff:** Suppose that the price of a share of stock in XYZ Corporation is currently trading at $30 per share. Consider buying the following two options on one share of XYZ:

a. A Call option with strike price $35
b. A Put option with strike price $25

i. (4 Points) Draw a payoff diagram of this portfolio

Note: *Clearly label both axes and the location of each important point on the diagram (Points of intersections, points where the graph changes direction, etc.).*

		$0	$25	$35	$50
long	C_{35}	0	0	0	$15
long	Put_{25}	$25	0	0	0



ii. (1 Point) What is the holder of this portfolio betting on?

The stock price will either rise above $35 or fall below $25 → betting on high volatility.

Formula Sheet

$\text{PV} \times (1 + r)^t = \text{FV}_t$ [5.3]

$$PV_0 = \frac{FV_t}{(1+r)^t}$$

$$\text{Annuity present value} = \frac{C}{r} \times \left(1 - \text{Present value factor}\right) = \frac{C}{r} \times \left\{1 - \frac{1}{(1+r)^t}\right\}$$ [6.1]

$$\textit{Annuity FV factor} = (\textit{Future value factor} - 1)/r = \left(\frac{(1+r)^t - 1}{r}\right)$$ [6.2]

Annuity due value = Ordinary annuity value × (1 + r) [6.3]

Perpetuity present value × Rate = Cash flow [6.4]

$$PV \times r = C$$

$$\textit{Annuity present value factor} = \frac{1}{r} \times (1\text{- Present } \textit{value factor})$$ [6.5]

$$\text{PV} = \frac{C}{r - g}$$ [6.6]

$$\text{PV} = \frac{C}{r-g}\left[1 - \left(\frac{1+g}{1+r}\right)^t\right]$$ [6.7]

$$EAR = \left(1 + \frac{QR}{m}\right)^m - 1$$ [6.8]

$\text{EAR} = e^q - 1$ [6.9]

$1 + R = (1 + r) \times (1 + h)$ [7.2]

$R \approx r + h$ [7.4]

$r = (D_1/P_0) + g$ [8.5]

$$\text{PV tax shield on CCA} = \frac{[IdT^c]}{d+k} \times \frac{[1+.5k]}{1+k} - \frac{S_n dT^c}{d+k} \times \frac{1}{(1+k)^n}$$ [10.5]

Total dollar return = Dividend income + Capital gain (or loss) [12.1]

$$Var(R) = \left(\frac{1}{(T-1)}\right) \times \left[(R_1 - \bar{R})^2 + \ldots + (R_T - \bar{R})^2\right]$$ [12.3]

Geometric average return $= [(1 + R_1) \times (1 + R_2) \times \cdots \times (1 + R_T)]^{1/T} - 1$ **[12.4]**

Risk premium = Expected return – Risk-free rate = $E(R_i) - R_f$ **[13.1]**

$$E(R) = \sum_j R_j \times P_j \quad \textbf{[13.2]}$$

$$\sigma^2 = \sum_j [R_j - E(R)]^2 \times P_j \quad \textbf{[13.3]}$$

$$\sigma = \sqrt{\sigma^2}$$

$$E(R_P) = x_1 \times E(R_1) + x_2 \times E(R_2) + K \ + x_n \times E(R_n) \quad \textbf{[13.4]}$$

$$\sigma^2_P = x^2_L \sigma^2_L + x^2_U \sigma^2_U + 2x_L x_U \text{CORR}_{L,U} \sigma_L \sigma_U \quad \textbf{[13.5]}$$

$$\sigma_P = \sqrt{\sigma^2_P}$$

Total return = Expected return + Unexpected return ➔ $R = E(R) + U$ **[13.6]**

Announcement = Expected part + Surprise **[13.7]**

R = E(R) + Systematic portion + Unsystematic portion **[13.8]**

Total risk = Systematic risk + Unsystematic risk **[13.9]**

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i \quad \textbf{[13.10]}$$

$$\beta_2 = \frac{\text{COV}(R_2, R_M)}{\sigma^2(R_M)} \quad \textbf{[13A.4]}$$

$$R_i = R_f + \beta_i \times [R_M - R_f] \quad \textbf{[14.2]}$$

$$WACC = \left(\frac{E}{V}\right) \times R_E + \left(\frac{P}{V}\right) \times R_P + \left(\frac{D_m}{V}\right) \times R_D \times (1 - T_C) \quad \textbf{[14.6]}$$

$C_1 = 0$ if $(S_1 - E) \leq 0$ **[25.1]**

$C_1 = S_1 - E$ if $(S_1 - E) > 0$ **[25.2]**

$C_0 \geq 0$ if $S_0 - E < 0$ **[25.4]**
$C_0 \geq S_0 - E$ if $S_0 - E \geq 0$

$S_0 = C_0 + E/(1 + R_f)$ **[25.5]**
$C_0 = S_0 - E/(1 + R_f)$

Call option value = Stock value – Present value of the exercise price **[25.6]**

$$C_0 = S_0 - E/(1 + R_f)^t$$

Stephen A. Ross