

APSC 221

Engineering Economics

Winter 2013

Final Examination – Wednesday April 24, 2013

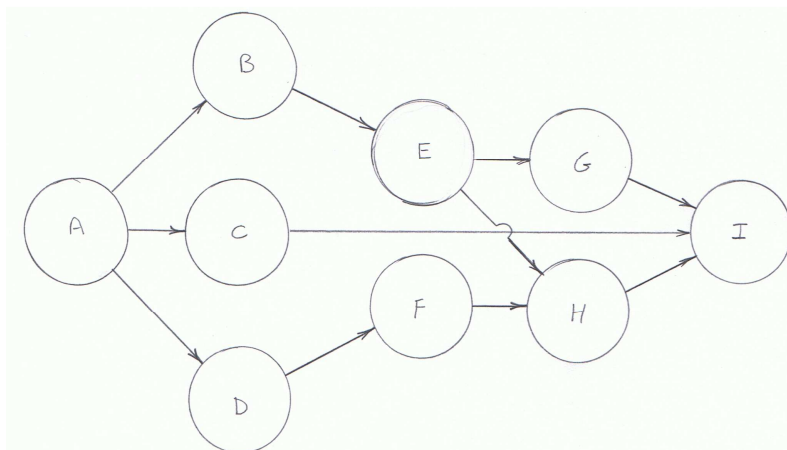
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Question 1: Project Scheduling (10 marks - 14%)

- a) Use the information in the table below to calculate the Expected Time and Variance for each activity using the PERT method. Record your answers using a table similar to the one below in your answer booklet. (2.5 marks for the values inside the box below – ¼ mark each)

Activity	Optimistic	Most Likely	Pessimistic	Expected	Variance	Critical Path	Expected	Variance
A	3	5	7	5.000	0.44	Yes	5	0.44
B	4.5	5	5.5	5.000	0.03	Yes	5	0.03
C	9	11	19	12.000	2.78	No		
D	4	6	8	6.000	0.44	No		
E	2	3	10	4.000	1.78	Yes	4	1.78
F	1	2	3	2.000	0.11	No		
G	4	5.5	10	6.000	1.00	No		
H	5	6.5	11	7.000	1.00	Yes	7	1.00
I	1.4	2.4	7	3.000	0.87	Yes	3	0.87
							24	4.12

- b) Use the expected values above and the activity-on-node diagram below to determine the critical path activities and the expected number of weeks to complete the project. Hint: The expected time is the same as the activity duration. Use the forward pass and backward pass of the CPM method to calculate the earliest start, earliest finish, latest finish and latest start times to determine which activities are on the critical path.



Critical path = A, B, E, H, I and expected completion is 24 weeks. (3.5 marks - A and I are given so 3 marks for "B, E, H" and ½ mark for 24 weeks)

- c) Determine the probability that the project completes in less than or equal to 23 weeks.

Sum of variances of critical path activities = $0.44 + 0.03 + 1.78 + 1.00 + 0.87 = 4.12$,

therefore $\sigma = \sqrt{4.12} = 2.03$ (1 mark)

$Z = (\text{Due Date} - \text{Expected Date}) / \sigma = (23 - 24) / 2.03 = -0.4926$, therefore from the standard normal distribution table probability is 0.3121 or 31.2% (1 mark)

- d) It is company tradition to hold a celebration party in the evening after a project completes. Assume that crews only work on regular business days, i.e. Monday through Friday and there are no holidays during the project so every week has exactly five days. If you want to be 98% confident, what week and day of the week do you tell your co-workers to book in their calendars for the party? For example your answer should be something like "Thursday of week 23". (2 marks)

From table $Z(98\%) = 2.05$ (½ mark), Date = Expected completion + $(Z \times \sigma) = 24 + (2.05)(2.03) = 28.17175685 = 28.16$ (½ mark)

Therefore; Week 28 and then 0.16×5 days = 1 day, which means the project will complete on the Monday of week 28. (1 mark)

or

From table $Z(98\%) = 2.055$ (½ mark), Date = Expected completion + $(Z \times \sigma) = 24 + (2.055)(2.03) = 28.17175685 = 28.17$ (½ mark)

Therefore; Week 28 and then 0.17×5 days = 1 day, which means the project will complete on the Monday of week 28. (1 mark)

or

From table $Z(98\%) = 2.06$ (½ mark), Date = Expected completion + $(Z \times \sigma) = 24 + (2.06)(2.03) = 28.17175685 = 28.18$ (½ mark)

Therefore; Week 28 and then 0.18×5 days = 1 day, which means the project will complete on the Monday of week 28. (1 mark)

Question 2: Time Value of Money (10 marks - 14%)

- a) What is the amount of interest earned on \$800 for 5 years at 10.5% simple interest? (½ mark)

$$\$800 \times 5 \times 0.105 = \$420.00$$

- b) What is the amount of interest earned on \$800 for 5 years at 10.5% compounded monthly? (½ mark)

$$P=800, i = 10.5/12 = 0.875\%, N = 5 \times 12 = 60 \rightarrow 800(F/P, 0.875\%, 60) - 800 = 800(1.68660) - 800 = \$549.28$$

- c) How much would you have to deposit every month to have the \$1,350 in the bank if the term, interest rate and compounding are the same as in part b) above? (½ mark)

$$A = 1,350(A/F, 0.875\%, 60) = 1350(0.01274) = \$17.20$$

- d) How much interest have you earned in c) ? (½ mark)

$$\$1,350 - \$17.20(60) = 1350 - 1032 = \$318.00$$

- e) Find the 7 uniform annual deposits that can provide a single withdrawal of \$48,500.00, 2 years after the last deposit is made at an interest rate of 8% per year. (1 mark)

First how much was \$48,500 worth 2 years ago, and then what annuity can generate that amount over 7 years.

$$A = \$48,500(P/F, 8\%, 2)(A/F, 8\%, 7) = \$48,500(0.85734)(0.11207) = \$41580.99(\frac{1}{2} \text{ mark})(0.11207) = \$4,659.98 (\frac{1}{2} \text{ mark})$$

Or

$$A = \$48,500(P/F, 8\%, 9)/(P/A, 8\%, 7) = \$48,500(0.50025)/(5.20637) = \$4,660.08 (1 \text{ mark})$$

- f) \$152,000 was deposited in a savings account 7 years ago, and the account earned interest at the rate of 8% per year. What is the amount of equal annual withdrawals that can be made to completely deplete the fund 7 years from now if the first withdrawal will be made now? (1 mark)

First trick here is recognizing that with annuities the first withdrawal is at the end of the first period of the annuity. So if the first withdrawal is now, we want to know how much \$52,000 was worth last year, i.e. at year 6.

Second trick is recognizing that if the fund ends 7 years from now, then it would end 8 years from last year.

$$A = \$152,000(F/P, 8\%, 6)(A/P, 8\%, 8) = \$152,000(1.58687)(0.17401) = \$41,971.95$$

- g) What value of G makes the two series of cash flows described below equivalent to each other at an interest rate of 7.77% per year, compounded every 3 months? (4 marks)

Cash Flow A: 22 annual deposits in the amount of \$200

Cash Flow B: 11 annual deposits, starting with \$200 in the first year, and increasing by \$G each year.

First need to figure out an effective annual interest rate.

$$i_e = \left(1 + \frac{0.0777}{4}\right)^4 - 1 = 0.07999 = 8\% \text{ (1 mark)}$$

Next P of an annuity that runs for 22 years $\rightarrow P = 200(P/A, 8\%, 22) = 200(10.20074) = \$2,040.15$ (1 mark)

Then need to recognize that cash flow B is made up of two parts a \$200 annuity for 11 years plus an arithmetic Gradient.

$$\$2,040.15 = \$200(P/A, 8\%, 11) \left(\frac{1}{2} \text{ mark}\right) + \$G(P/G, 8\%, 11) \left(\frac{1}{2} \text{ mark}\right)$$

$$\therefore \$G = [\$2,040.15 - \$200(7.13896)] / 30.26566 = \$20.23 \text{ (1 mark)}$$

- h) A small electronics manufacturer expects total revenues to decrease over the next 4 years due to the recession. The company forecasts that the revenue will be \$19 million in the first year, but will decline by \$2 million every year for the next 3 years. What is the present worth of total revenue at an interest rate of 11.387% per year, compounded monthly? (2 marks)

$$i = [(1 + 0.11387/12)^{12}] - 1 = 12.0005\% \left(\frac{1}{2} \text{ mark}\right)$$

$$PW = 19(P/A, 12\%, 4) \left(\frac{1}{2} \text{ mark}\right) - 2(P/G, 12\%, 4) \left(\frac{1}{2} \text{ mark}\right) = 19(3.03735) - 2(4.12731) = 57.70965 - 8.25462$$

$$PW = \$49.455 \text{ million} \left(\frac{1}{2} \text{ mark}\right)$$

OR

$$PW = 19(P/F, 12\%, 1) \left(\frac{1}{4} \text{ mark}\right) + 17(P/F, 12\%, 2) \left(\frac{1}{4} \text{ mark}\right) + 15(P/F, 12\%, 3) \left(\frac{1}{4} \text{ mark}\right) + 13(P/F, 12\%, 4) \left(\frac{1}{4} \text{ mark}\right)$$

$$PW = 19(0.89286) + 17(0.79719) + 15(0.71178) + 13(0.63552) = 16.96434 + 13.55223 + 10.6767 + 8.26176$$

$$PW = \$49.455 \text{ million} \left(\frac{1}{2} \text{ mark}\right)$$

Question 3: Cost Concepts (5 marks - 7%)

You are deciding between three types of space heaters for a winter construction project. The associated costs are shown below. The cost of operation for propane and oil heaters is estimated by $(41,045/\text{Efficiency Factor}) \times \text{Fuel Cost}$ per Btu per day, and the cost to operate the electric heaters is estimated by $(12.03/\text{Efficiency Factor}) \times \text{Electricity Cost}$ per kWh per day. The selected heater will be used December 1 to March 31 ($31 + 31 + 28 + 31 = 121$ days) then sold at the market value. Which alternative should be selected? (5 marks)

Alternative	Electric	Gas	Oil
Price of space heater	\$28,000	\$23,500	\$25,000
Efficiency Factor	2.0	0.57	0.75
Fuel Cost	\$0.16/kWh	\$0.00001/Btu	\$0.00001/Btu
Maintenance costs	\$300	\$220	\$250
Market value	\$25,200	\$20,700	\$22,500

Electric cost = $(28,000 - 25,200) + 300 + (121 \times 12.03 / 2.0 \times 0.16) = 2,800 + 300 + 116.45 = \$3,216.45$ (1.5 marks)

Propane cost = $(23,500 - 20,700) + 220 + (121 \times 41045 / 0.57 \times 0.00001) = 2,800 + 220 + 87.33 = \$3,107.13$ (1.5 marks)

Oil cost = $(25,000 - 22,500) + 250 + (121 \times 41045 / 0.75 \times 0.00001) = 2,500 + 250 + 66.22 = \$2,816.22$ (1.5 marks)

Revenue is not a consideration so choose least costly alternative. Recommend the Oil alternative. (½ mark)

Question 4: Comparison Methods (5 marks - 7%)

Three mutually exclusive projects are under consideration for an irrigation system. The first is a concrete reservoir with a steel pipe system and the second is an earthen dam with a wooden aqueduct. Both projects have essentially infinite lives, provided adequate maintenance is performed. Or you could buy a truck and haul water from a nearby lake. Calculate the present worths of the alternatives using an interest rate of 8%. What assumption do you need to make to be able to perform the comparison? Which alternative should be chosen?

	Concrete Reservoir	Earthen Dam	Truck
First Cost	\$500,000	\$200,000	\$50,000
Annual costs	\$2,000	\$12,000	\$25,000
Replace wooden aqueduct every 15 years.	N/A	\$100,000	N/A
Salvage at 10 years	N/A	N/A	\$2,000

$PW_{\text{Concrete}} = 500,000 + 2,000/0.08 = \$525,000.00$ (1 mark)

$PW_{\text{Earthen}} = 200,000 + 12,000/0.08 + 100,000(A/F, 8\%, 15)/0.08 = 350,000 + 1,250,000(0.03683) = \$396,037.50$ (1.5 marks)

$PW_{\text{Truck}} = [50,000(A/P, 8\%, 10) + 25,000 - 2,000(A/F, 8\%, 10)]/0.08 = [50,000(0.14903) + 25,000 - 2,000(0.06903)]/0.08 = \$403,918.00$ (1.5 marks)

Assume that an infinite number of equal trucks can be purchased. (½ mark)

The Earthen Dam is the better choice. (½ mark)

or

$$AW_{\text{Concrete}} = 500,000(0.08) + 2,000 = \$42,000.00 \text{ (}\frac{1}{2}\text{ mark)}$$

$$PW_{\text{Concrete}} = 42,000/0.08 = \$525,000.00 \text{ (}\frac{1}{2}\text{ mark)}$$

$$AW_{\text{Eathen}} = 200,000(0.08) + 12,000 + 100,000(0.03683) = \$31,683 \text{ (1 mark)}$$

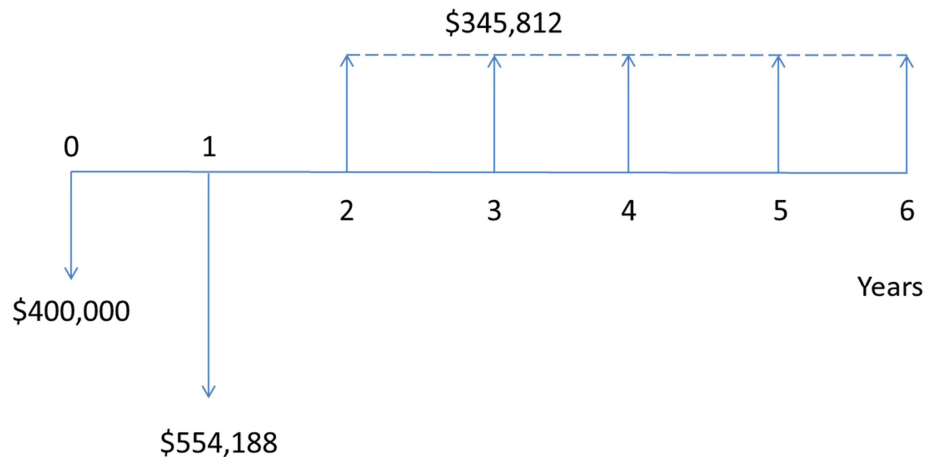
$$PW_{\text{Eathen}} = 31,683/0.08 = \$396,037.50 \text{ (}\frac{1}{2}\text{ mark)}$$

$$AW_{\text{Truck}} = 50,000(A/P, 8\%, 10) + 25,000 - 2,000(A/F, 8\%, 10) = 50,000(0.14903) + 25,000 - 2,000(0.06903) = \$32,313.44 \text{ (1 mark)}$$

$$PW_{\text{Truck}} = 32,313.44/0.08 = \$403,918 \text{ (}\frac{1}{2}\text{ mark)}$$

Question 5: Internal Rate of Return (5 marks - 7%)

Determine the internal rate of return for the project depicted by the cash flow diagram below.



First recognize that $\$554,188 + \$345,812 = \$900,000$

$$PW = 0 = -400,000 - 900,000(P/F, i^*, 1) + 345,812(P/A, i^*, 6) \text{ (3 marks)}$$

Try $i^* = 20\%$,

$$PW = 0 = -400,000 - 900,000(P/F, 20\%, 1) + 345,812(P/A, 20\%, 6)$$

$$PW = 0 = -400,000 - 900,000(1/1.2) + 345,812(3.32551) = \$1.26, \text{ which is close enough to zero. } \therefore i^* \sim 20\% \text{ (2 mark)}$$

Or

$$PW = 0 = -400,000 - 554,188(P/F, i^*, 1) + 345,812(P/A, i^*, 5)(P/F, i^*, 1) \text{ (3 marks)}$$

Try $i^* = 20\%$,

$$PW = 0 = -400,000 - 554,188(P/F, 20\%, 1) + 345,812(P/A, 20\%, 5)(P/F, 20\%, 1)$$

$$PW = 0 = -400,000 - 554,188(1/1.2) + 345,812(2.99061)(1/1.2) = \$0.69, \text{ which is close enough to zero. } \therefore i^* \sim 20\% \text{ (2 mark)}$$

Question 6: Inflation (3 marks - 4%)

Wexler Mining Systems wants to determine when it should buy a second new front-end loader. They can buy a new one for \$200,000 today or sign a contract to pay \$300,000 for a new one three years from now. Inflation is currently 1.786% and is expected to rise to 2.679% a year from now. From an economic perspective should the company buy now or buy later if their real MARR is 12%?

$$\text{MARR}_{\text{Actual-Year1}} = (1+0.12)(1+0.01786) - 1 = 0.1400032 \Rightarrow 14\% \text{ (1 mark)}$$

$$\text{MARR}_{\text{Actual-Year2-3}} = (1+0.12)(1+0.02679) - 1 = 0.1500048 \Rightarrow 15\% \text{ (1 mark)}$$

$$\text{FW} = 200,000(\text{F/P}, 14\%, 1)(\text{F/P}, 15\%, 2) = 200,000(1.14)(1.32250) = \$301,530.00 \text{ (}\frac{1}{2}\text{ mark)}$$

\therefore They should sign the contract and wait. ($\frac{1}{2}$ mark)

Or

$$\text{PW} = 300,000(\text{P/F}, 15\%, 2)(\text{P/F}, 14\%, 1) = 300,000(0.75614)(0.87719) = \$198,983.53 \text{ (}\frac{1}{2}\text{ mark)}$$

\therefore They should sign the contract and wait. ($\frac{1}{2}$ mark)

Or

Take \$300,000 Actual and convert to Real $300,000/(1.01786)(1.02679)^2 = \$279,556.73$ (2 marks), now move that amount back to year zero with the real MARR, $279,556.73(\text{P/F}, 12\%, 3) = 279,556.73(0.71178) = \$198,982.89$ ($\frac{1}{2}$ mark)

\therefore They should sign the contract and wait. ($\frac{1}{2}$ mark)

Question 7: Taxes (4 marks - 6%)

A new energy efficient boiler costs \$55,000 and would save \$17,000 per year compared to the existing one. Salvage value is estimated to be \$1,000 at the end of its 15 year life. The CCA rate is 20% and the corporate tax rate is 38%. The after-tax MARR is 12%. What is the after-tax present worth of the new boiler?

$$\text{CTF} = 1 - \frac{td\left(1+\frac{i}{2}\right)}{(i+d)(1+i)} = 1 - [(0.38)(0.2)(1+0.12/2)] / [(0.12+0.2)(1+0.12)] = 1 - 0.08056/0.3584 = 0.77522 \text{ (1 mark)}$$

$$\text{CSF} = 1 - \frac{td}{(i+d)} = 1 - [(0.38)(0.2)] / (0.12+0.2) = 1 - 0.076/0.32 = 0.7625 \text{ (1 mark)}$$

$$P = -55,000(\text{CTF}) + 17,000(\text{P/A}, 12\%, 15)(1 - 0.38) + 1000(\text{P/F}, 12\%, 15)(\text{CSF}) \text{ (1.5 marks)}$$

$$P = -55,000(0.77522) + 17,000(6.8109)(0.62) + 1000(0.1827)(0.7625) = \$29,289.10 \text{ (}\frac{1}{2}\text{ mark)}$$

Question 8: Financial Accounting and Capital Budgeting (8 marks - 11%)

Investing in equity is more risky than investing in debt. Equity owners are paid only if the company first meets its contractual obligations to lenders. This higher risk means that equity owners have an expectation of a greater return on average than the interest rate paid to debt holders. Consider a simple case in which a company has three possible performance outcomes - weak results, normal results, and strong results. Investors do not know which performance outcome will actually occur. Each outcome is equally probable. Assume that all after-tax income is paid to equity holders as dividends. The available data is shown in the following Table.

	Weak Results	Average Results	Strong Results
Net Operating income (\$/year) ¹	130,000	200,000	270,000
Interest payments (\$/year)	21,000	21,000	21,000
Income before tax (\$/year)	109,000	179,000	249,000
Tax at 40% (\$/year)	43,600	71,600	99,600
After-tax Net Income = Dividends (\$/year)	65,400	107,400	149,400
Debt (\$)	150,000	150,000	150,000
Equity = Book value of shares (\$)	537,000	537,000	537,000

¹ Net operating income per year is revenue per year minus costs (other than interest) per year.

- a) What is the return the lenders are being paid? (½ mark)
Lenders are being paid a return of $\$21,000/\$150,000 = 0.14 = 14\%$
- b) What are the three possible returns the owners can receive, i.e the three Return on Equity (ROE) ratios? (1.5 marks)
Weak: $\$65,400/\$537,000 = 0.12178 = 12.2\%$
Average: $\$107,400/\$537,000 = 0.2 = 20.0\%$
Strong: $\$149,000/\$537,000 = 0.27821 = 27.8\%$
- c) What is the weighted average cost of capital (WACC) for this company? (3 marks)
 $WACC = \lambda (1 - t)i_b + (1 - \lambda)e_a$
 $\lambda = \frac{150,000}{150,000 + 537,000} = 0.218, \therefore 1 - \lambda = 0.782$ (1 mark)
 $WACC = 0.218(1 - 0.4)14\% + (0.782)20\% = 0.018312 + 0.1564 = 0.174712 = 17.5\%$ (2 marks)
Or
 $WACC = 0.218(1 - 0.4)14\% + (0.782)12.2\% = 0.018312 + 0.095404 = 0.174712 = 11.4\%$
 $WACC = 0.218(1 - 0.4)14\% + (0.782)20\% = 0.018312 + 0.1564 = 0.174712 = 17.5\%$
 $WACC = 0.218(1 - 0.4)14\% + (0.782)27.8\% = 0.018312 + 0.217396 = 0.174712 = 23.6\%$
 $(11.4 + 17.5 + 23.6)/3 = 17.5\%$ (2 marks)
- d) If the market returned 8% this year and Canadian Government bonds paid 2%, using the CAPM model what would the three beta (weak, average, strong) values be? (1.5 marks)
 $e_a = R_S = R_F + \beta_S(R_M - R_F)$
 $\beta_{Weak} = (12.2\% - 2\%) / (8\% - 2\%) = 1.7$
 $\beta_{Average} = (20.0\% - 2\%) / (8\% - 2\%) = 3.0$
 $\beta_{Strong} = (27.8\% - 2\%) / (8\% - 2\%) = 4.3$
- e) If Current Liabilities were \$45,000 calculate the Equity ratio and the after-tax Return on Assets ratio for the average results? (1.5 marks)
Total Assets = Total Equity + Total Liabilities = $537,000 + 150,000 + 45,000 = 732,000$ (½ mark)
Equity Ratio = Total Equity / (Total Equity + Total Liabilities) = $537,000/732,000 = 0.7336$ (½ mark)
Return on Assets (ROA) = Net Income / Total Assets
 $ROA_{Average} = 107,400/732,000 = 0.1467 = 14.7\%$ (½ mark)

Question 9: Dealing with Uncertainty and Risk (12 marks – 17%)

You are trying to decide whether to buy the patent for a product designed by another company. The decision to buy will mean an investment of around \$6 million, however the demand for the product is not known. If demand is light, you expect a return of \$1.3 million each year for **three years**. If demand is moderate, you expect the return will be \$2.5 million each year for **four years**. If demand is high, then estimates are that you can expect revenues of \$4.0 million a year for **five years**. Based on previous investment history you have determined that the probability of light demand is 0.2 and that there is a 0.3 probability of high demand. The corporate MARR is 12%.

- a) Calculate the expected **present worth** of the patent. On this basis, should you recommend making the investment? (5 marks)

$$PW(\text{Light}) = -6.0 + 1.3(P/A, 12\%, 3) = -6 + 1.3(2.40183) = -2.877621 \text{ (1 mark)}$$

$$PW(\text{Moderate}) = -6 + 2.5(P/A, 12\%, 4) = -6.0 + 2.5(3.03735) = 1.593125 \text{ (1 mark)}$$

$$PW(\text{High}) = -6.0 + 4.0(P/A, 12\%, 5) = -6.0 + 4.0(3.60478) = 8.41912 \text{ (1 mark)}$$

$$\text{Expected PW} = -2.877621(0.2) + 1.593125(0.5) + 8.41912(0.3) = 2.7467743 = \$2,746,774 \text{ (1 mark)}$$

Yes, only if the demand is light will we lose money and the expected value is almost \$2.75 million which is $PW > 0$. (1 mark)

- b) How sensitive is the analysis to changes in the initial cost if your negotiating skills prove to be poor; by what percent does the expected present worth of the patent change for a +10% increase in initial cost? (5 marks)

$$PW(\text{Light}) = -6.6 + 1.3(2.40183) = -3.477621 \text{ (1 mark)}$$

$$PW(\text{Moderate}) = -6.6 + 2.5(3.03735) = 0.993375 \text{ (1 mark)}$$

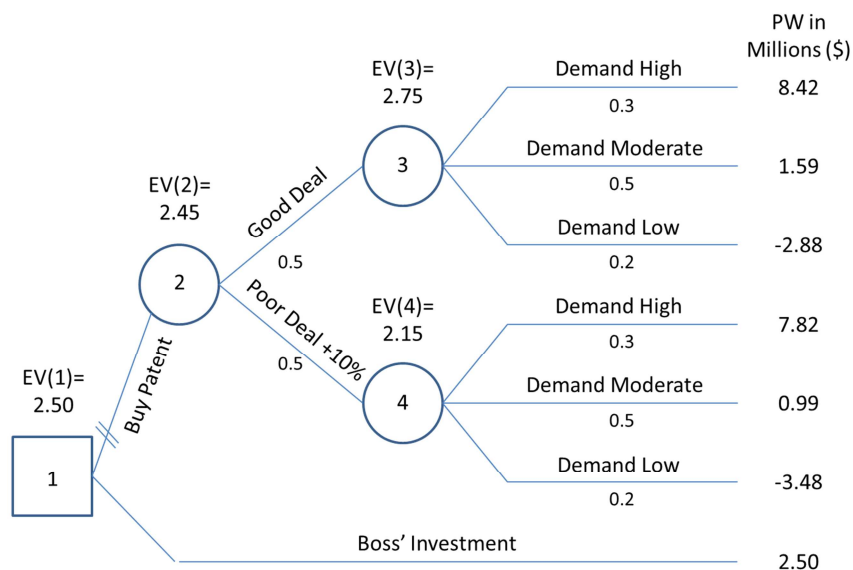
$$PW(\text{High}) = -6.6 + 4.0(3.60478) = 7.81912 \text{ (1 mark)}$$

$$\text{Expected PW} = -3.477621(0.2) + 0.993375(0.5) + 7.81912(0.3) = 2.1468993 = \$2,146,899 \text{ (1 mark)}$$

$$(\$2,146,899 - \$2,746,774) / \$2,746,774 = -21.8\% \text{ (1 mark)}$$

- c) Your boss comes to you at the last minute and tells you he has found another mutually exclusive investment with an expected present worth of \$2.5 million. You figure that your negotiating skills are only 50/50, meaning that 50 percent of the time you will get the patent deal for \$6 million and the other 50 percent of the time you will pay 10% more for the deal. Construct a well labeled decision tree to represent this scenario and make a recommendation to your boss about which deal the company should pursue. (2 marks)

$$\text{Expected Value} = \$2,746,774(0.5) + \$2,146,899(0.5) = \$2,446,836.5$$



Question 10: All Chapters (½ mark for each = 10 marks – 14%)

Write your answers in your exam booklet **NOT** on this page.

Please write the answers in a single column, one answer per line, on a page of its own.

Select the one alternative that best completes the statement or answers the question.

- A. Individuals who both recognize and seize opportunities are referred to as
- 1) independents.
 - 2) **entrepreneurs.**
 - 3) intrapreneurs.
 - 4) franchisees.
 - 5) speculators.
- B. Low start-up costs and simplicity of operations are among the main advantages of _____.
- 1) a co-operative
 - 2) **a sole proprietorship**
 - 3) selling shares
 - 4) incorporating
 - 5) none of these
- C. A decrease over time in average prices of goods and services is called _____.
- 1) project variance
 - 2) monetary easing
 - 3) sunk costs
 - 4) payback
 - 5) **deflation**
- D. Project managers face ethical decisions on a daily basis. Which is an example of such?
- 1) Offers of gifts from contractors
 - 2) Pressure to alter status reports
 - 3) False reports for charges of time
 - 4) Pressures to compromise quality to meet penalty schedules
 - 5) **all of these**
- E. When alternatives for accomplishing a specific task are being compared over one year or less they are referred to as Present Economic Studies and _____.
- 1) the before-tax MARR is used
 - 2) only the Present Worth is calculated
 - 3) **the time value of money can be ignored**
 - 4) the present worth of costs is set equal to the present worth of revenues
 - 5) none of these
- F. One significant cost that is often forgotten is the effect on the time of everyone affected by change. Many people in the organisation will need to give up time to _____.
- 1) explain how things work to those involved in designing changes
 - 2) be consulted on the effectiveness and realism of planned change
 - 3) provide ideas for improvements
 - 4) be trained and have changes explained to them
 - 5) **all of the above**

- G. The effective interest rate is the actual but not usually stated interest rate when the compounding period is not calculated on an annual basis. Which of the following statement is true?
- 1) Effective will always be above nominal, regardless of the number of compounding periods
 - 2) Effective will always be below nominal, regardless of the number of compounding periods
 - 3) Effective will always be above nominal, when there is more than one compound period in the year
 - 4) Effective will always be below nominal, when there is more than one compound period in the year
 - 5) none of these
- H. The formulas we use for arithmetic gradients always convert the gradients into either a Present or Annual worth cash flow _____ time periods before the first non-zero gradient amount.
- 1) one
 - 2) two
 - 3) three
 - 4) four
 - 6) none of these
- I. Which of the following is **NOT** one of the risk management steps?
- 1) analysis of probability and consequences
 - 2) mitigation strategies
 - 3) planning and scheduling
 - 4) risk identification
 - 5) control and documentation
- J. If the annual savings are not constant, we can calculate the payback period by _____.
- 1) setting the present worth of all costs equal to the present worth of all savings
 - 2) the ratio of first cost over the first year sum of all savings
 - 3) accounting for the need to recover capital quickly
 - 4) deducting each year of savings from the first cost until the first cost is recovered
 - 5) none of these
- K. The text states that a disadvantage of using the internal rate of return method is that _____.
- 1) we need to calculate the after-tax MARR
 - 2) the method used is only an approximation
 - 3) there may be more than one internal rate of return
 - 4) interest tables are not provided in fractional amounts
 - 5) linear interpolation between interest rates is not 100% accurate
- L. The CAPM asserts that the return on any stock depends upon its risk relative to the _____.
- 1) weighted average cost of capital
 - 2) the portion of debt financing
 - 3) market
 - 4) risk free interest rate
 - 5) weighted average cost of equity
- M. Sensitivity analysis is an approach to project evaluation that can be used to gain a better understanding of how _____.
- 1) management decisions effect the likelihood of change management success or failure
 - 2) uncertainty affects the evaluation by examining changes to project parameters
 - 3) the probability distribution function changes over time
 - 4) to assess the consequences, or effect, of its occurrence
 - 5) to mitigate the severity of negative consequences

- N. Companies are taxed on _____.
- 1) revenues
 - 2) **net profits**
 - 3) expenses
 - 4) assets
 - 5) equity
- O. Once an asset has been installed and has been operating for some time, the costs of installation and other expenses incurred up to that time are _____.
- 1) are depreciated over the estimated life of the asset after taking into account the half-year rule
 - 2) **called sunk costs and are no longer relevant to any decision to replace the current asset**
 - 3) are referred to as real dollars and the cash flow needs to be adjusted to make them actual
 - 4) are required to be reported to the Canada Revenue agency so an accurate salvage value can be provided
 - 5) all of the above
- P. Inflation _____.
- 1) describes the increase in monetary exchange rates as determined by market forces
 - 2) **is the increase over time in average prices of goods and services**
 - 3) is how the probability of tax rate changes due to environmental forces
 - 4) assesses the consequences of expanding market share
 - 5) mitigates the severity of negative consequences
- Q. One particularly useful summary statistic is the expected value, which is the _____ of a random variable.
- 1) variance
 - 2) mode
 - 3) **mean**
 - 4) standard deviation
 - 5) range
- R. A project organization can choose to _____ risk.
- 1) accept
 - 2) minimize
 - 3) share
 - 4) transfer
 - 5) **all of the above**
- S. What are the two dimensions of change management?
- 1) organisational and strategic
 - 2) **human and organisational**
 - 3) tactical and strategic
 - 4) stories and legends
 - 5) business and competitive
- T. When conducting a replacement analysis, where the defender and challenger are identical, what condition needs to be true?
- 1) Equivalent annual cost of capital must be increasing over time.
 - 2) Total annual costs can be described as a simple parabola ($Y=aX^2+bX+c$).
 - 3) **Revenues are the same for both alternatives.**
 - 4) Sunk costs are known and can be incorporated in the analysis.
 - 5) Equivalent annual cost of maintenance expenses must be decreasing.