

ENGINEERING ECONOMICS
ECO 1192A

Second Partial Examination
SOLUTIONS

C.Théoret

Fall 2005

Please Note:

1. You have 75 minutes (7 pm to 8:15 pm) to complete Partial Examination #2 which consists of **32 multiple choice questions**.
2. All questions must be answered on the Scantron sheet.
3. Please indicate your name, student number and course number on the front of the Scantron sheet. Failure to provide this information could result in the cancellation of your examination.
4. Correct answers are worth one (1) point and incorrect answers zero (0).
5. You may keep the examination questionnaire.
6. You **MUST** show your University of Ottawa I.D. card as you hand-in the answer sheet **AND** sign the attendance sheet.
7. Thank you.

INFORMATION FOR QUESTIONS 1 to 3

<i>DETAILS</i>	<i>PROJECT A</i>	<i>PROJECT B</i>
First Cost(\$)	20,000	30,000
Economic Life (years)	5	10
Annual Revenues (\$)	15,000	12,000
Annual operating cost (\$)	5,000	4,000 in the first year

		followed by annual decreases of \$200 (e.g., 4,000 in year 1; 3,800 in year 2, etc.)
Salvage Value (\$)	1,000	-5,000
MARR (%)	10	10

1. Based on a simple payback method, the recovery period for Project A is:
 - a) 1 year
 - b) 1.9 years
 - c) **2 years = $[20,000 / (15,000 - 5,000)] = 2$**
 - d) 3 years
 - e) None of the above answers.

2. If the standard recovery period for projects similar to A is 1.5 years based on the Simple Payback Method, project A is
 - a) Acceptable
 - b) **Not acceptable (2 years > 1.5 years)**
 - c) Impossible to determine its acceptability based on the information available.
 - d) None of the above answers.

3. Based on a discounted payback method, the project balance for Project B after 3 years is
 - a) -30,000
 - b) -25,000
 - c) -19,300
 - d) **-12,830**
 - e) None of the above answers.

YEAR	CASH FLOW	OPPORTUNITY COST (10% discount rate)	PROJECT BALANCE
0	-30,000	--	-30,000
1	8,000	3,000	-25,000
2	8,200	2,500	-19,300
3	8,400	1,930	-12,830

4. The discounted payback method usually requires a longer recovery period than the simple payback method because the opportunity cost of its project balance is zero.
- a) True
 - b) False**
5. The payback method (whether simple or discounted) always leads to the same conclusion as the Net Present Worth Method as to the acceptability of a project.
- a) True
 - b) False**

INFORMATION FOR QUESTIONS 6 to 8

A new combine has a \$200,000 price tag and is expected to reduce farm operating costs by \$80,000 per year for five (5) years. Assume:

- An after-tax MARR of 10%
- A salvage value of \$50,000 in five years
- A 20% depreciation rate
- An income tax rate of 50%.

6. Using an appropriate capital tax factor, determine the after-tax present worth cost of this combine excluding any offsetting tax savings from its non-zero salvage value and cost savings (i.e., focus on the after-tax “P” only)
- a) \$200,000
 - b) \$100,000
 - c) \$136,364**
 - d) \$50,000
 - e) None of the above answers
7. Using an appropriate capital tax factor, determine the after-tax present worth of the combine’s salvage value.
- a) \$200,000
 - b) \$50,000
 - c) \$20,697**
 - d) \$150,000

- e) None of the above answers
8. Determine the after-tax present worth of the reductions (savings) in maintenance and operating costs generated by the use of the new tractor.
- a) \$80,000
 b) \$40,000
 c) \$400,000
 d) $\$80,000(P/A,10\%,5)(1-t)$
 e) None of the above answers (=\$151,632)

<u>INFORMATION FOR QUESTIONS 9 to 13</u>					
CCA \equiv capital cost allowance UCC \equiv undepreciated capital cost () \equiv the disposition of assets. Assume: <ul style="list-style-type: none"> • d = 20% (Declining Balance) • t = 50% • a half-year rule 					
Year	Adjustments to UCC from Purchases & Dispositions	Base UCC Amount for CCA (\$)	CCA (\$)	Remaining UCC (\$)	Tax Savings Due to CCA (\$)
1995	\$400,000	200,000	AA = 40,000	BB = 360,000	20,000
1996	(\$100,000)	CC= 260,000	52,000	208,000	DD = 26,000
1997	\$200,000	308,000	EE = 61,600		
1998	(\$100,000)				

9. The dollar amount of cell AA is
- a) \$200,000
 b) \$320,000
 c) \$400,000
 d) **None of the above answers.**

10. The dollar amount of cell BB is
a) **\$360,000**
b) \$400,000
c) \$250,000
d) None of the above answers
11. The dollar amount of cell CC is
a) \$300,000
b) **\$260,000**
c) \$308,000
d) None of the above answers.
12. The dollar amount of cell DD is
a) \$300,000
b) \$308,000
c) \$600,000
d) **None of the above answers**
13. The dollar amount of cell EE is
a) \$100,500
b) \$252,000
c) **\$61,600**
d) None of the above answers
14. A capital cost tax factor (CCTF) captures and summarizes tax savings arising from the depreciation of a fixed or capital asset.
a) **True**
b) False
15. The internal rate of return after-tax ($IRR_{\text{after-tax}} \approx (IRR_{\text{before-tax}})(1 - \text{tax rate})$)
a) **True**
b) False
16. When the service requirements for a capital asset extend beyond the defender's remaining service life, it is usually assumed that the defender will be replaced by a lower-cost asset.
a) True
b) **False**
17. Reasons for the replacement of a capital (fixed) asset include
a) deterioration, inflation, obsolescence
b) deterioration, obsolescence and owner preference
c) **deterioration, obsolescence, inadequacy**
d) obsolescence, inadequacy and preference

18. Economic life is defined as
- the period of time over which a prudent owner will retain an existing facility to minimize costs.**
 - the period of time after which an asset can no longer be repaired or refurbished so that it can perform a useful function
 - the period of time after which an asset cannot perform its intended function without a major overhaul
 - the length of time an asset might reasonably be expected to be useful in the production of income.
19. The two major perspectives on the replacement of fixed assets are
- Insider and cash flow
 - Insider and owner
 - Insider and consultant**
 - Outsider and consultant
20. **Deleted**
21. In a defender/challenger replacement situation, the defender **HAS NOT reached its economic life**. The decision to replace or keep the defender will depend on the relationship between the cost of keeping the defender one more year and the challenger's annual equivalent cost (based on the challenger's economic life).
- True
 - False**

INFORMATION FOR QUESTIONS 22 to 24

Your company purchased a new truck last year. You were informed today that a more efficient truck is now available. Details pertaining to both trucks are given below. Neither truck is **beyond its economic life**. MARR = 10%.

DETAILS	DEFENDER	CHALLENGER
First Cost(\$)	40,000 (last year)	---
Current Market Value (\$)	30,000	50,000
Economic Life (years)	5	10
Annual operating cost (\$)	20,000 in the first year	25,000 per year

	followed by annual increases of \$2,000	
Salvage Value (\$)	1,000	-4,000

22. The annual equivalent cost of the defender (if not beyond its economic life) can be obtained from
- $-40000(A/P,10\%,5) + 1000(A/F,10\%,5) - 20000 + 2000(A/G,10\%,5)$
 - $-30000(A/P,10\%,5) + 1000(A/F,10\%,5) - 20000 - 2000(A/G,10\%,5)$**
 - $-30000(A/P,10\%,5) + 1000(A/F,10\%,5) - 20000 + 2000(A/G,10\%,5)$
 - $-40000(A/P,10\%,10) + 1000(A/F,10\%,10) - 20000 - 2000(A/G,10\%,5)$
 - None of the above answers
23. The annual equivalent cost of the challenger can be obtained from
- $-50000(A/P,10\%,5) - 4000(A/F,10\%,5) - 25000$
 - $-30000(A/P,10\%,5) - 3000(A/F,10\%,5) - 25000$
 - $-50000(A/P,10\%,10) - 4000(A/F,10\%,10) - 25000$**
 - $-30000(A/P,10\%,10) - 5000(A/F,10\%,10) - 25000$
 - None of the above answers
24. If the defender was beyond its economic life, its annual equivalent cost calculation for the coming year would be
- $-40000(A/P,10\%,1) + 1000(A/F,10\%,1) - 20000 - 2000(A/G,10\%,1)$
 - $-30000(A/P,10\%,1) + 1000(A/F,10\%,1) - 20000 - 2000(A/G,10\%,1)$
 - $-30000(A/P,10\%,1) + 1000(A/F,10\%,1) + 20000$
 - $-40000(A/P,10\%,10) + 1000(A/F,10\%,10) + 20000 - 2000(A/G,10\%,5)$
 - None of the above answers (the defender's salvage value in one year is not given)**

INFORMATION FOR QUESTIONS 25 to 27

Item Number	Selected Balance Sheet and Income Statement Items for ABC Company Limited
1	Cash
2	Retained Earnings

INFORMATION FOR QUESTIONS 25 to 27

Item Number	Selected Balance Sheet and Income Statement Items for ABC Company Limited
3	Interest Expense for current year
4	Inventories of finished goods
5	Total Sales for year
6	Working Capital Loan from Bank XYZ
7	Income Taxes for this year
8	Depreciation Expense for current year
9	Cost of Goods Sold this year
10	Common Shares
11	Corporate Bonds Payable by ABC in 7 years
12	Accounts Receivable
13	Accounts Payable
14	Long-Term (10 years) Bond Investments by ABC
15	Historical Cost of Plant and Equipment
16	Cumulative Plant & Equipment Depreciation
17	Income Taxes Owed from last year (payable now)
18	Contributed Capital
19	Dividends Paid to Shareholders

25. Item number 9 is
- a) **an Expense/Income Statement item**
 - b) an asset/Balance Sheet item
 - c) a liability/Balance Sheet item

- d) an Owners' Equity/Balance Sheet item
 e) None of the above answers.
26. Item number 12 is
 a) an Expense/Income Statement item
b) an asset/Balance Sheet item
 c) a liability/Balance Sheet item
 d) an Owners' Equity/Balance Sheet item
 e) None of the above answers.
27. Item number 19 is
 a) an Expense/Income Statement item
 b) an asset/Balance Sheet item
 c) a liability/Balance Sheet item
 d) an Owners' Equity/Balance Sheet item
e) None of the above answers.

INFORMATION FOR QUESTIONS 28 to 32

A firm is considering the purchase of a truck for \$200,000 fully installed. It is expected to last 3 years with a salvage value of \$50,000 at that time. Revenues from operations will be \$300,000 each year and operating and maintenance costs will be \$100,000 each year.

- Depreciate the truck using the DB method ($d=20\%$).
- The before-tax interest rate is 10%.
- The after-tax interest rate is 5%.
- A 50% tax rate on income from operations and the recapturing of depreciation.
- The **half-year rule** applies

The firm gets a \$60,000 loan (at a 10% rate of interest) which is repaid as follows:

Repayment of loan at the end of year	Percentage of loan repaid
1	25
2	35
3	40

Item	Cash Flows			
	End of year ...			
	0	1	2	3
1. Before Tax Cash Flow	AA= -200,000			
2. Annual Depreciation		BB= $0.2 \times 200,000 \times 0.5$ =20,000	CC= $0.2(200,000 - 20,000)$ = 36,000	(200,000 - 20,000 -36,000)0.2 = 28,800
3. Interest Expense				
4. Taxable Income				
5. Taxes Payable				
6. After Tax Cash Flow				
3. Interest Expense				
7. Loan Repayment				
8. Cash Flow on Owner Equity	DD = -200,000 + 60,000 = -140,000			

28. The numerical value of cell AA is
- \$50,000
 - \$200,000**
 - \$140,000
 - \$150,000
 - None of the above answers
29. The numerical value of cell BB is
- \$40,000
 - \$50,000
 - \$20,000**
 - \$60,000
 - None of the above answers
30. The numerical value of cell CC is
- \$40,000
 - \$32,000
 - \$36,000**
 - \$50,000

- e) None of the above answers
31. The numerical value of cell DD is
- a) \$6,000
 - b) \$4,500
 - c) \$3,000
 - d) \$2,400
 - e) **None of the above answers**
32. The net salvage value (NSV) of the truck after three (3) years would be
- a) \$50,000
 - b) **\$82,600**
 - c) \$17,400
 - d) \$0
 - e) None of the above answers ($= 200,000 - 20,000 - 36,000 - 28,800 = 115,200$)

***** **THE END** *****

ENGINEERING ECONOMICS
ECO 1192A

Third Partial Examination

C.Théoret

Fall 2005

ANSWERS

Please Note:

- 1. You have 75 minutes to complete Partial Examination 3 which consists of 25 multiple choice questions.**
- 2. All questions must be answered on the Scantron sheet.**
- 3. Please indicate your name, student number and course number on the front of the Scantron sheet. Failure to provide this information could result in the cancellation of your Partial Examination.**
- 4. Correct answers are worth one (1) point and incorrect answers zero (0).**
- 5. You MUST show your University of Ottawa I.D. card as you hand-in the answer sheet.**

1. The process of examining the impact on a summary measure (e.g., Future Worth) of changing one project parameter at a time includes
 - a) Sensitivity plots and breakeven analyses
 - b) Breakeven analyses and scenario analyses
 - c) Scenario analyses and sensitivity plots
 - d) None of the above answers**
2. Breakeven analyses allow an analyst to examine the sensitivity of a summary measure (e.g., Future Worth) to concurrent (together) changes to all project parameters.
 - a) True
 - b) False**
3. In an uncertain environment, the decision-maker has sufficient information to determine the probability of occurrence of future events or outcomes.
 - a) True

b) False

4. If you apply a breakeven analysis to two mutually exclusive projects that have identical revenues but different costs, which of the following criterion would you use to determine the range over which one project is better than the other?
 - a) maximum criterion
 - b) minimum criterion**
 - c) a minimum and a maximum criterion
 - d) none of the above answers.
5. Analyses by scenario allow the analyst to examine the sensitivity of a summary measure (e.g., Present Worth) to project parameters estimated in a specific future state.
 - a) True**
 - b) False
6. The strength of scenario analysis is that all project parameters are estimated independently of each other.
 - a) True
 - b) False**
7. Most breakeven analyses have a fixed cost component because
 - a) variable costs are not reliable
 - b) fixed costs are linear
 - c) they are short term analyses**
 - d) they are long term analyses.
8. The concept of cost, in this course, is defined as economic or opportunity cost. Hence, economic cost differs from accounting cost because
 - a) it excludes explicit costs
 - b) includes both explicit and implicit costs**
 - c) excludes both explicit and implicit costs
 - d) none of the above answers.
9. In Monte Carlo simulation, the probability distributions of the individual random variables pertaining to a project are known in advance.
 - a) True**
 - b) False
10. By randomly sampling values for project parameters from their probability distributions, Monte Carlo simulation
 - i) produces a sample of the overall performance measure of a project
 - ii) imitates the randomness in the performance measure as a result of the randomness of the project variables or inputs.

- a) both i) and ii) are correct
- b) i) is correct but ii) is incorrect.
- c) i) is incorrect but ii) is correct
- d) both i) and ii) are incorrect.

<u>INFORMATION FOR QUESTIONS 11 TO 15</u>		
A lawn care company needs an additional tractor to complete a "big" job on time. It can buy or lease the tractor.		
DETAILS	BUY	LEASE
First Cost (\$)	30,000	----
Life (years)	6	----
Salvage value (\$)	4,000	----
Operating Expenses (\$)	50/day	----
Maintenance contract (\$)	3,000/year	----
Leasing cost (\$)	----	130/day
MARR (%)	10	10

11. The buy option's annual equivalent fixed cost is about
 - a) \$6,370
 - b) 520
 - c) 9,370**
 - d) None of the above answers

12. The buy option's total annual variable cost is [where "N" is days per year]
 - a) 130N
 - b) 50N**
 - c) 80N
 - d) None of the above answers

13. The break-even point (days per year) between the buy and lease options is about
 - a) 117 days per year**
 - b) 79 days per year
 - c) 86 days per year
 - d) None of the above answers.

14. If the estimated use of the tractor is 90 days per year, the better option is
 a) Buy
b) Lease
 c) Can't decide from the available information
 d) Neither project
15. If the estimated use of the tractor is 130 days per year, the better option is
a) Buy
 b) Lease
 c) Can't decide from the available information
 d) Neither project
16. The Benefit-Cost method uses a net benefit concept whereby annual operating costs are subtracted from all revenues and cost savings generated by a project.
 a) True
b) False
17. Assume that public projects A and B have valid simple benefit-cost ratios. Project A has a larger first cost and a higher benefit-cost ratio than Project B. Can you conclude that Project A is better than Project B?
a) Yes
 b) No.

INFORMATION FOR QUESTIONS 18 to 19						
Project	FIRST COST (M\$)	Individual B/C Ratio	INCREMENTAL B/C RATIOS			
			<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
A	10	1.6				
B	15	2.7	1.5			
C	20	1.7	0.9	1.2		
D	29	1.3	1.1	0.9	1.3	
E	35	1.1	0.8	0.5	0.8	0.9

18. If public projects A, B, C, D and E are independent (there is no budget constraint), the acceptable projects are:
a) A, B, C, D and E
 b) A, B, C and D
 c) A, B and C
 d) None of the above answers.

19. If projects A, B, C, D and E are mutually exclusive, the BEST project is
- a) A
 - b) B
 - c) C
 - d) D**
 - e) E

INFORMATION FOR QUESTIONS 20 TO 22

- John bought a five-year \$20,000 Guaranteed Income Certificate (GIC) on January 1, 2005 for which he paid \$20,000. He will receive \$1,000 in interest income on December 31 of each year from December 2005 to December 2009.
- On December 31, 2009 (the GIC's maturity date), John's \$20,000 investment will be fully reimbursed.
- During the five-year period, inflation is expected to be 2 percent per year.

$$\begin{aligned}(P/F,5\%,5) &= 0.78353; & (F/P,5\%,5) &= 1.2763 \\ (A/P,5\%,5) &= 0.23097; & (P/A,5\%,5) &= 4.3295 \\ (A/F,5\%,5) &= 0.18097; & (F/A,5\%,5) &= 5.5256\end{aligned}$$

$$\begin{aligned}(P/F,2\%,5) &= 0.90573; & (F/P,2\%,5) &= 1.1041 \\ (A/P,2\%,5) &= 0.21216; & (P/A,2\%,5) &= 4.7135 \\ (A/F,2\%,5) &= 0.19216; & (F/A,2\%,5) &= 5.2040\end{aligned}$$

20. What is the combined (i.e., market interest) rate of interest (to 2 decimals) on the GIC?
- a) 5.00%**
 - b) 3.00%
 - c) 7.00%
 - d) None of the above answers
21. What is the real (inflation-free) rate of interest (to 2 decimals) on the GIC?
- a) 2.94%**
 - b) 0.97%
 - c) 7.24%
 - d) None of the above answers

22. If John can reinvest the annual interest income from the GIC at a rate equivalent to the rate on the GIC, what will be the future worth (on December 31, 2009 (to the nearest \$100) of his total investment in constant (i.e., real or January 1, 2005 dollars)?
- a) \$20,000
 - b) \$15,700
 - c) \$23,100**
 - d) \$18,100
 - e) None of the above answers.

Information for questions 23 to 25		
U of O engineering students are planning a major rock concert for all university and college students in Ottawa-Gatineau area. An early May date has been selected for the concert. However, these entrepreneurial students are not sure whether to hold the concert indoors or outdoors for fear of rain (and maybe snow).		
Net profits from the concert are shown below.		
Venues	Rain (prob. = 0.4)	Sunshine (prob. = 0.6)
Football field	\$40,000	\$100,000
Auditorium	\$60,000	\$80,000

23. The expected value of the indoor (auditorium) option is
- a) \$76,000
 - b) \$100,000
 - c) \$72,000**
 - d) None of the above answers.
24. The expected value of perfect information is
- a) \$76,000
 - b) \$84,000**
 - c) \$60,000
 - d) None of the above answers.
25. The value of perfect information is
- a) \$76,000
 - b) \$4,000
 - c) \$8,000**
 - d) None of the above answers.