UCLA

Introduction to Technology Management for Engineers

ENG110 Final Exam SOLUTIONS Spring 2013 Meliha Bulu-Taciroglu

Last Name, First Name:_____

Signature _____ Student ID# _____ I certify I am the above listed person and this is my individual work.

Today's date is: 6/ 10 / 2013

The exam is closed book and closed notes; you may use the formula sheet provided. There is no talking or questions to be asked during the exam. Only one student may go to the restroom at a time; if you go, leave your cell phone with the proctor. Select your answer based solely on what you think is the best answer possible given the question as written. If you use the back of the exam, write "answer on back" on the front of that page. All comments will be considered when grading the exam. The exams will be collected in 3 hours.

Good luck!

Multiple Choice Questions (2 points each)

1. Which of the following fits into economists' definition of irrational behavior?

a) When a celebrity endorses a product, sales increase even though the endorsement does not convey any information about the quality.
b) Rock concerts sell out weeks in advance but the prices aren't raised.
c) A man pays a dollar to play for $5 million lottery instead of $8 million lottery with exactly the same odds.
d) A girl buys a poetry book with no intention of reading it to impress her friends.
e) A relatively new social network company, Facebook, is valued more than a well-established company, like General Motors, even tough Facebook has lower yearly earnings.

2. You are about to start a company to sell laptop computer accessories. You paid $4,000 to a market research company to identify the profile of your target customers. You are planning on using a family property which used to be rented for $12,000/year, as your office. You will need an industrial designer and supplies and equipment. An industrial designer costs $1,800/month and supplies and equipment will cost $24,000/month. Ignoring discounting, what is the total cost that you should include in your NPV calculations for the first year?

a) 25,800
b) 309,600
c) 321,600
d) 325,600
e) 468,800

3. In the previous question $4,000 is ……..cost and $12,000 is …….cost.

a) marginal, variable
b) variable, marginal
c) total, opportunity
d) opportunity, sunk
e) sunk, opportunity

4. In a typical production process, specialization is represented by

a) the intersection of MC and ATC curves
b) upward sloping MC curve
c) steep portion of the TFC
d) flattening portion of TVC curve
e) the increasing portion of the u-shaped ATC curve

5. If for a perfectly competitive firm, price is equal to the minimum of ATC curve, then which of the following is NOT correct:

a) Firm does not make positive economic profit
b) At the optimum production level, total revenue is equal to total cost
c) Optimum production occurs at a quantity where ATC is minimum
d) Since firm is making zero economic profit, the resources would bring higher returns at their alternative uses.
e) At the optimum production level; price, marginal cost, and average total cost coincide.

6. Considering the recent economic events, which of the following is NOT correct about the U.S. economy?

a) U.S. GDP growth has deviated from its long-term trend.
b) Chinese growth rate has been consistently higher than U.S. growth rate in the past decade.
c) Relative U.S. share of the world GDP was fairly stable over the years.
d) After the 2008 economic crisis, U.S. has been experiencing relatively high inflation.
e) The country with the highest GDP in the world is US.

7. Interstate highway 405 has the properties of

a) a pure public good
b) a pure private good
c) both public and private goods
d) an imported good
e) an exported good

8. A positive externality:

a) would not cause any market failure
b) would result in underproduction
c) would be automatically internalized
d) would not necessitate intervention
e) is avoidable

9. Kals Investment Group will receive a sum of $75,000 two years later for an investment of $40,000 if event A were to occur, and will receive nothing if event A were not to occur. The probability of event A occurring is 90%. The expected rate of return for this investment is _____.

a) 30%
b) 40%
c) At least 60%
d) Between 10% and 20%
e) 22%

10. You make the right decision by accepting a project with an IRR of 13% when the market rate is 16%. Then, for the project:

a) cash flow changes sign more than once.
b) the initial cash flow is positive.
c) the initial cash flow is negative.
d) the first few years' cash flow is zero.
e) cash low is uniform.

Short Answer Questions (3 points each):

11. What amount must be deposited into a savings account that pays 8% interest if the inflation rate is 10% and you want to set aside enough money to purchase a red tape cutting machine ten years after the deposit? The current cost of a red tape cutting machine is $10,000.

Deposit =? f = 10% i = 8% n = 10 Years Initial cost = $10,000
Future price = P (F/P, f, n) = 10,000(F/P, 10%, 10) = 10,000(2.5940) = $25,940
Present worth = Future price (P/F, i, n) = 25,940(P/F, 8%, 10) = 25,940(0.4632) =$12,015.41

13. Taking the U.S. as a base, the PPP adjusted GDP per capita is $48,387 in U.S. and $36,236 in Finland. Can you discern which country is cheaper using only the information given?

The information is not enough to discern whether Finland is cheaper or more expensive than US. If the nominal GDP (unadjusted for PPP) for Finland was given, we would be able to compare relative prices in US and Finland.

14. If the consumption function for an economy is C=180+0.75Y, and intended investment rises by $800, and government spending which is financed by taxing an equal amount, rises by $400, what would be the resulting change in national income?

Since marginal propensity to consume (MPC) is 0.75, income multiplier is 1/(1-0.75)=4.
*The change in national income due to change in investment is 800*4=3,200.*
The change in national income due to change in government spending and tax is 400.
Then, total change is 3,200+400=,3600

15. Does an average American consumer spend more on services or on tangible goods within a year?

The spending on services is almost twice as much as the spending on goods in U.S.

16. The nominal GDP increased from $6,379 to $6,420 from 2004 to 2005, but the real GDP decreased from $6,018 to $5,681. What was the inflation rate over the course of one year?

*Real GDP=(Nominal GDP/GDP Deflator)*100, then GDP Deflator for 2004 is (6,379/6,018)*100 = 105.99, for 2005 (6,420/5,681)*100 = 113.*
Then price increase from 2004 to 2005 is 113/105.99 = 1.066, that is 6.6%.

17. Which country is the number one trading partner of U.S.?

Canada

18. Is Nominal GDP always greater than the Real GDP? Why or why not?

If inflation is negative, that is if there is deflation (prices going down), then real GDP would be greater than nominal GDP.

19. Currently U.S. has a higher budget deficit (as a percentage of GDP) compared to (most) previous years. Is cutting government spending a good idea under current economic conditions? Why or why not?

No. When the economy is not at its full potential, cutting government spending and/or increasing taxes will further slow down the economy.

20. In the recent years there has been a high output gap between the potential and actual GDP in US. What would you do with each of the following monetary policy tools? Circle the one that you recommend in each case:

Federal Funds Rate:	LOWER	RAISE
Government Bonds:	BUY	SELL
Reserve Requirement Ratio:	LOWER	RAISE

Numeric Problems:

21. The following table gives the units of resources needed to produce 1 unit of each commodity in Taiwan and Singapore.

	Medical Equipment	Flat Panel
Taiwan	6	1
Singapore	12	4

a) (3 points) Does Taiwan have an absolute advantage in the production of any commodity? Does Singapore? Why or why not?

Taiwan has an absolute advantage in both the production medical equipment and flat panels. Singapore does not have an absolute advantage in the production of any good.

b) (3 points) Does Taiwan have a comparative advantage in the production of any commodity? Does Singapore? Why or why not?

Opportunity cost of producing 1 unit of Medical Equipment is 6 Flat Panels in Taiwan and 3 Flat Panels in Singapore. Singapore has a comparative advantage in Medical Equipment production and Taiwan has a comparative advantage in Flat Panel production. Then Singapore should specialize in Medical Equipment production and Taiwan should specialize in Flat Panel production.

22. (10 points) XYZ Co. needs to borrow 100 units of country L money, where the interest rate would be equal to 10% (i_L = 10%). Alternatively, XYZ can borrow the money in country F, where the interest rate would be equal to 12.75% (i_F = 12.75%). The current exchange rate (e_0) between countries L, and F is (CF / CL) = 10, where CF and CL represent equivalent amounts of currency of countries F and L respectively. In other words, one unit of country L currency is equivalent to ten units of country F currency.

The loan will be repaid in one year. There is uncertainty about the exchange rate next year (e_1). It is equally likely to be 9.5, 10, or 10.5. What is the probability (pr) that XYZ will be better off by borrowing in country F rather than country L?

t	L	F
0	100.00	1,000.00
1	- 110.00	- 1,127.50

If XYZ borrows in L, it will pay back 110 L units.

If XYZ borrows in F, it will pay back 1,127.5 F units. This is equal to 1,127.5/9.5 = 118.68 with probability 1/3, 112.75 with probability 1/3, and 107.38 with probability 1/3. Hence with 1/3 probability XYZ is better off by borrowing in country F.

23. (8 points) Ross System received a price quote for a CNC router for a cost of $50,000. The operation and maintenance cost is expected to be about $2,000 per year. Salvage value is expected to be zero when the machine is retired. Since it is a machine based on a new design, the life is expected to vary anywhere from 4 to 7 years with the associated probabilities as shown in the table below. If the interest rate is 12%, what is the expected EUAC for this router?

Life, Years	4	5	6	7
Probability	10%	20%	40%	30%

EUAC for a 4-year life = 50,000(A/P, 12%, 4) + 2,000 =50,000(0.3292) + 2,000 =$18,460
EUAC for a 5-year life = 50,000(0.2774) + 2,000 = $15,870
EUAC for a 6-year life = 50,000(0.2432) + 2,000 = $14,160
EUAC for a 7-year life = 50,000(0.2191) + 2,000 = $12,955
Expected EUAC = 0.10(18,460) + 0.20(15,870) + 0.40(14,160) + 0.30(12,955) = $14,571

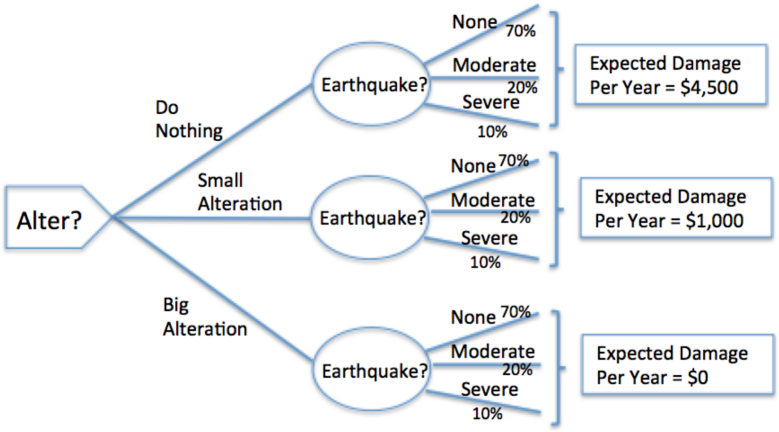
24. A nuclear facility is located in an area subject to occasional earthquakes. You have been brought in as a consultant to determine whether retrofitting the building is economically justified. The alternatives are as follows:

I. Do nothing. Damage in a moderate earthquake is $10,000 and in a severe earthquake is $25,000.
II. Alter the building at a cost of $15,000 to withstand the moderate earthquake without damage and to withstand severe earthquake with $10,000 damages.
III. Alter the building at a cost of $20,000 to withstand a severe earthquake without damage.

In any given year, there is no earthquake with 70% chance, a moderate one with a 20% chance and a severe one with a 10% chance.

Interest is 15% and a 15-year analysis period is used.

a) (4 points) Draw the decision tree, make sure to use the correct shapes for nodes, label them and add the probabilities when necessary.



b) (6 points) Solve the decision tree.

*Expected Value of Doing Nothing: -4,500 (P/A, 15%, 15) = -4,500 * 5.847 = -$26,311.5*
Expected Value of Small Alteration:
*-15,000 -1,000 (P/A, 15%, 15) = -15,000 -1,000 * 5.847 = -$20,847*
Expected Value of Big Alteration: -$20,000

Big Alteration is the best decision.

25. (8 points) A firm finances a $40 million project by borrowing $20 million to be repaid over the life of the project and by issuing common stocks worth of $20 million. Determine the required rate of return, both before- and after-tax. Borrowed funds cost 10%, equity costs 20%, and the tax rate is 40%.

Before-Tax Cost:
The before-tax rate of return (ibt) is simply the weighted average cost of the two financing modes.
Weighted cost = Cost X Proportion
Amount Proportion Cost Weighted Cost
Borrowed Funds (Debt) $20M: 50% X 10% = 5%
Common Stock (Equity) $20M 50% X 20% =10%
Total $40M 100%: 15%
Alternatively, compute the total return requirement in dollars and express it as a percent of total.
Cost of debt interest: 10% of $20 million = $2,000,000.
Cost of equity 20% of $20 million = $4,000,000.
Total Cost: 15% of $40 million = $6,000,000.

After-Tax Cost:
After-tax cost = Before-tax Cost X (1 - TR) = 0.1 X (1 - 0.4) = 0.06 = 6%. (Only cost of debt is tax deductible.)
Amount Proportion Cost Weighted Cost
Borrowed Funds (Debt) $20M: 50% X 6% = 3%
Common Stock (Equity) 20M: 50% X 20% =10%
Total $40M 100%: 13%

26. (8 points) The CROC Co. is considering a new milling machine. They have narrowed the choices down to three alternatives in addition to the Null (Do nothing) alternative. The relevant data are shown in the table below.

	Economy	Regular	Deluxe
First Cost	$75,000	$125,000	$220,000
Annual Benefit	$28,000	$43,000	$79,000
Annual Costs	$8,000	$13,000	$38,000
Salvage Value	$3,000	$6,900	$16,000

All machines have a life of ten years. Using **incremental rate of return analysis**, which alternative should the company choose? Use a MARR of 15%.

Order the options in increasing First Costs: Null, Economy, Regular, and Deluxe.

Increment (Null up to Economy):
NPW = -75,000 + {(28,000 - 8,000) (P/A, i, 10)} + {(3,000(P/F, i, 10)}.
= -75,000 + {20,000(P/A, 15%, 10)} + {3,000(P/F, 15%, 10)} = $26,121.60.
Since, NPW is greater than $0, incremental IRR(Internal Rate of Return) is greater than MARR.
Accept Economy.

Increment (Economy up to regular):
NPW = (125,000 - 75,000) + [{(43,000 - 13,000) - (28,000 - 8,000)} (P/A, i, 10)] + {(6,900 - 3,000) (P/F, i, 10)}.
= -50,000 + {10,000 (P/A, 15%, 10)} + {(3,900(P/F, 15%, 10)} = $1,154.08.
Since, NPW is greater than $0 incremental IRR is greater than MARR.
Accept Regular.

Increment (Regular up to Deluxe, i):
NPW = - (220,000 - 125,000) + [{(79,000 - 38,000) - (43,000 - 13,000)} (P/A, i, 10)] + {(16,000 - 6,900) (P/F, i, 10)}.
= -95,000 + {11,000(P/A, 15%, 10)} + {(9,100 (P/F, 15%, 10)} = -$37,541.48.
Since, NPW is less than $0, incremental IRR is than MARR. .
Reject Deluxe.
Regular should be chosen.

I. Cost Structure and Estimation: TC=TVC+TFC, ATC = TC/Q, MC= ΔTC /ΔQ

$$\frac{\text{Cost}_A}{\text{Cost}_B} = \frac{\text{Index}_A}{\text{Index}_B} \qquad \text{Cost}_A = \text{Cost}_B\left(\frac{\text{Size}_A}{\text{Size}_B}\right)^x$$

$T_N=T_{initial}$ x N^b, **where** b=log(learning curve rate)/log2

II. Single Payment:

$F = P(1+i)^n$ $F = P(F/P, i, n)$ $P = F(1+i)^{-n}$ $P = F(P/F, i, n)$

III. Effective Rate: $i_a = (1+\frac{r}{m})^m - 1$

IV. Uniform Series:

$$F = A\left[\frac{(1+i)^n - 1}{i}\right] = A(F/A, i, n) \qquad A = F\left[\frac{i}{(1+i)^n - 1}\right] = A(A/F, i, n)$$

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right] = P(A/P, i, n) \qquad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] = A(P/A, i, n)$$

Arithmetic Gradient Present Worth Factor:

$$P = G\left[\frac{(1+i)^n - i\cdot n - 1}{i^2(1+i)^n}\right] = G(P/G, i, n)$$

Arithmetic Gradient Uniform Series Factor

$$A = G\left[\frac{(1+i)^n - i\cdot n - 1}{i(1+i)^n - i}\right]$$
$$= G\left[\frac{1}{i} - \frac{n}{(1+i)^n - 1}\right] = G(A/G, i, n)$$

Geometric Gradient Present Worth Factor:

$$P = A_1\left[\frac{1-(1+g)^n(1+i)^{-n}}{i-g}\right] \quad \text{where} \quad i \neq g \qquad P = \frac{n\cdot A_1}{(1+i)} \quad \text{where} \quad i = g$$

Capitalized Cost: $A = Pi$

V. GDP = C+I+G+(X-M), Real GDP = (Nominal GDP/GDP Deflator) *100

Fisher Formula: (1+real rate) = (1+ nominal rate) / (1+ inflation)

VII. Expected Value and Risk Formulas: $Mean\ value = \frac{O+4M+P}{6}$ $1 \geq \text{Probability} \geq 0$

$\sum_{j=1 \text{ to } k} P(\text{outcome}_j) = 1$ $P(A \text{ and } B) = P(A)\times P(B)$

$$\text{Expected Value} = \sum_{\text{all } j} \text{Outcome}_j \times P(j)$$
$$= \text{Outcome}_A \times P(A) + \text{Outcome}_B \times P(B) + \cdots$$