UCLA Technology Management & Economics for Engineers and Scientists E110

Midterm Exam Fall 2011 Prof. Bristow Version A

Write your first and last name here: _____Section:_____

Signature _____ Student ID# _____

I certify I am the above listed person.

Write your seat number here _____ and turn in your seat assignment with your exam.

Have you taken Eng 111 or 112 before this quarter? If yes, which classes have you taken?

_____

Today's date is: ___/___/___ Time I began exam: _____ I ended at: _____

The exam is closed book and closed notes; you may use the equation page. 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. Check to see if your exam packet has __ pages. Select your answers based solely on what you think is the best answer possible given the question as written. If you feel that there is an error or typo in a question or an answer, you are encouraged to write your comments on the exam. 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 one hour and 30 minutes.

There are 30 questions of different value, so pace yourself so that you finish on time and have time to check your work. There are multiple versions of the exam; the person next to you will not have your version of the exam. Do not even appear to be looking at your neighbor's exam.

There are no trick questions but some questions may have information that you don't require. Read the question – do not assume what is says; read it carefully.

Good luck, relax and think clearly about what you have learned. You will do well.

Short answer questions (25 points total)

Q1. (2 pts) Write out the equation to define gross domestic product (use variables):
This question is from the lecture notes

GDP = I + G + C + (X-M)

Q2. (2 pts) Define all 5 variables on the right side of the GDP equation (use words):

I = Investments
G = Government spending
C = Consumption
X = Exports
M = Imports

Q3. (2 pts) Complete the following chart regarding recent US GDP data in 2010 (all numbers must be accurate to +/- .1%):
This question is form current events

	Q1 2010	Q2 2010
GDP:	0.4	1.3
Inventory:	-0.4	0.3
GDP at final sales:	0	1.6

Q4. (6 pts) List the approximate historical (1926-2006) annual yields (for the 6 major categories of investments (HINT: Dow is a dozen):

This question is from lecture notes

Private Equity:	24%
Small Cap Stock:	18%
Large Cap Stock:	12%
LT Corp/ Govt Bonds:	6%
T-Bills:	4%
Inflation:	3%

Q5. (5 pts) List the 9 steps involved in the engineering economic analysis framework in their **correct order**:
This question is from chapter 1

1. Recognize the problem
2. Define the goal or objective
3. Assemble relevant data
4. Identify feasible alternatives
5. Select criterion to determine the best alternative
6. Construct a model
7. Predict each alternative's outcomes or consequences
8. Choose the best alternative
9. Audit the result

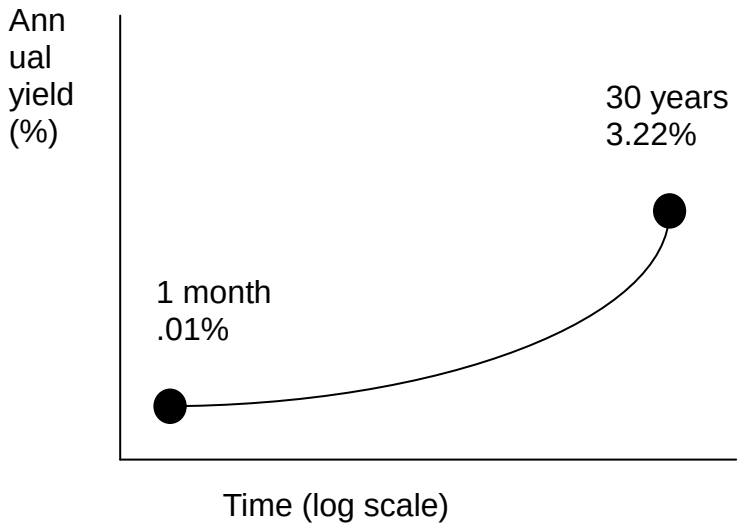
Q6. (2 pt) What is the current price of oil per barrel? (Numbers must be accurate +/- $5)
This question is from current events

$91.60 as of Monday October 24th, 2011

Q7. (2 pt) What is current US unemployment? What is considered full employment? (Numbers must be accurate to +/- 1%)
This question is from current events

9.1% for September 2011; Full employment = 6% unemployment

Q8. (5 pts) Sketch the current yield curve as published by the US Treasury. Label both axes. Indicate scale on both axes. Mark at least 2 points on the yield curve (numbers must be accurate to +/- .25%)
This question is from lecture notes



Important features: slope/general shape, axes, and the labeled points

Q9. (2 pts) What is the rise in the current yield curve? (uses basis point as your unit)

322 – 1 = 321

Multiple Choice and True/False Questions (20 points total)

Q10. (2pts) Which of the following countries is one of the PIIGS nations?

a) Sweden
b) Ireland
c) Poland
d) Iceland
e) Germany

Q11. (2pts) Which of the following is the term **revenue** synonymous with?
This question is from chapter 2

a) Sales
b) Liability
c) Assets
d) Equity
e) Profit

Q12. Which of the following is in the range of federal funds target rate for inflation?
a) 0%
b) 0.25%
c) 1.0%
d) 2.0%
e) None of the above

Q13. (3 pts) Complete the following equation:

Breakeven point = (_____) / (Selling price per unit – Variable price per unit)
This question is from chapter 2
a) Book cost
b) Opportunity cost
c) Marginal cost
d) Fixed cost
e) Cash cost

Q14. (3 pts) From your 9-step problem solving analysis, what does a model refer to?
a) A SWOT analysis
b) An example of what other people have done to tackle the problem before
c) A mathematical equation which predicts the outcome of your proposed solutions
d) A chart or graph summarizing your plans for the entire 9-step analysis
e) All of the above

Q15. (3 pt) Which of the following is an example of insider trading?
a) An employee buying and selling his own company's stock
b) An employee selling his company's trade secret to a competitor
c) An employee trading his company's securities in possession of nonpublic information about the securities
d) A and C
e) All of the above

Q16. (True/False) Depreciation is an example of a sunk cost. (Chap 2 – depreciation is a book cost)

Q17. (True/False) A real interest rate is defined as: nominal interest rate – inflation.

Q18. (True/False) When choosing between two alternatives, the one with greater EUAC is always preferred.

Q19. (True/False) A profit and loss statement is synonymous to an income statement.

Computational Questions (55 points total)

Q20. (7 pts) You plan on starting a food truck business by buying a truck with a built in kitchen. You first ask your parents for help, and they agree to give you a $10,000 investment for a share of your company. In order to buy all the equipment necessary you also take out a $30,000 loan from the bank and use the money to buy the truck and cooking supplies. You still have $5000 leftover cash as after you finish purchasing supplies.
This question is from chapter 17
(5 pts) Draw a basic diagram of your balance sheet. Include the truck, cooking supplies, the loan, the investment, and the leftover cash listed under assets, liabilities, or equity.

Assets	Liabilities
Cash	Loan
Supplies	Equity
Truck	Investment

(2 pts) Assuming A = L + E and your cooking supplies cost $2000, what was the price of the truck?

L + E = $40k = $2k + $5k + truck; truck = $33k

Q21. (3 pts) How much will Tom accumulate in a bank account that pays 5% annual interest compounded quarterly if he deposits $800 at the end of each quarter for 7 years?

i = 5%/4 = 1.25%
n = 4*7 = 28

$$F = 800\left[\frac{(1+0.0125)^{28}-1}{0.0125}\right] = \$26{,}623.51$$

Q22. (5 pts) What uniform annual payment for 12 years is equivalent to receiving all of the following:

$3,000 at the end of each year for 12 years
$20,000 today
$4,000 at the end of 6 years
$800 at the end of each year forever
$10,000 at the end of 15 years

use 8% interest rate.

$$PV = 3000\left[\frac{(1+0.08)^{12}-1}{0.08(1+0.08)^{12}}\right] + 20{,}000 + 4000\left[\frac{1}{(1+0.08)^{6}}\right] + 800\left[\frac{1}{0.08}\right] + 10{,}000\left[\frac{1}{(1+0.08)^{-15}}\right]$$
$$= \$\ 58{,}280$$

$$A = PV\left[\frac{(1+0.08)^{12}\,0.08}{(1+0.08)^{12}-1}\right] = 7733.78$$

Or

$$A_1 = \$3000$$
$$A_2 = 20{,}000\left[\frac{(1+0.08)^{12}\,0.08}{(1+0.08)^{12}-1}\right] = \$2654$$
$$A_3 = 4000\,(1+0.08)^{-6}\left[\frac{(1+0.08)^{12}\,0.08}{(1+0.08)^{12}-1}\right] = \$331.51$$
$$A_4 = (800/0.08)\left[\frac{(1+0.08)^{12}\,0.08}{(1+0.08)^{12}-1}\right] = \$1327$$
$$A_5 = 10{,}000\ (1+0.08)^{-15}\left[\frac{(1+0.08)^{12}\,0.08}{(1+0.08)^{12}-1}\right] = \$418.27$$

$$A = \$3000 + \$2654 + \$331.51 + \$1327 + \$418.27 = \$7733.78$$

Q23. The production of an automobile requires a large amount of manual labor. 2000 labor hours were required to produce the 1st unit in the production run and 350 hours were required to produce the 500th unit
(2 pts) What is the learning curve coefficient for this production process? Round your answer to the nearest 0.1.

LC: $\ln(LC) = b \cdot \ln 2 \Rightarrow LC = \exp(b \cdot \ln 2)$
$\Rightarrow LC = 0.823$

(2pts) Suppose the same automobile production is now completely automated. No humans are directly involved in the assembly. With the same learning curve model, what would be the expected learning curve coefficient?

LC will be equal to 1 (or b = 0). We essentially have $T_N = T_1$ for all N, meaning the time required to produce the first unit will be equivalent to the time required to produce unit N for any point in the future. An automated process does not learn or become faster over time.

Q24 (2pts) How much money should you save annually in order to have $120,000 in 47 years? Interest rate is 7%

$$120{,}000 = A\left[\frac{(1+0.07)^{47} - 1}{0.07}\right]$$

A = $364.49

Q25. (6pts) The expected return on the market is 13%, with a risk-free rate of 7%, along with a corporate tax of 35%. ABC Inc. has a beta of 1.29, and a Debt-Equity Ratio of 1. What is ABC Inc's Weighted Average Cost of Capital, when the firm has a before-tax cost of debt of 7%?

WACC = We.Ke+Wd.Kd
Kd = i(1-Tax)
CAPM or Ke = Rf + B(Rm-Rf)

So, the Required Rate of Return or Cost of Equity would be:

=.07 + (.13-.07)*1.29
=.07 + .0774
=.1474 or 14.74%

Cost of Equity/Ke = 14.74%

Since the Debt-Equity Ratio is 1, ABC Inc. has equal weights of debt and equity.
WACC = .5 * [.07(1-.35)] + .5 (.1474)

= .02275 + .0737

= .09645 = 9.65%

Q26. (5pts) What amount of money deposited 10 years ago at an 8% interest rate would provide a perpetual payment of $8,000 a year beginning this year?

Figure out the present value of the annuity in today's dollars: P = C/r = $8k/.08 = $100k
Discount that value back 10 years: FV = 100k = PV(1.08)^10
Solve for the "present" (10 yrs ago) value: PV = $ 46,319

Q27. (6 pts) You want to buy a machine that costs $1500 and generates $800 every 2 years. You need to pay $200 every three years for maintenance. The machine lasts for 6 years. Assuming a 2% interest rate, how much is the equivalent uniform annual value/worth for this machine?

$NPV = -1500 + 800\,(1+0.02)^{-2} + 800\,(1+0.02)^{-4} + 800\,(1+0.02)^{-6} - 200\,(1+0.02)^{-3} = 531.61$

$$EUAW = NPV\left[\frac{(1+0.02)^6 0.02}{(1+0.02)^6 - 1}\right] = \$94$$

Q28. (5pts) An analysis by net present value (NPV) is to be made for the purchase of two devices A and B. If an 5% interest rate is used, recommend the device to be purchased.

	Cost	Uniform Annual Benefit	Salvage at the End of Useful Life	Useful Life
Device A	$600	$100	$250	3 years
Device B	700	100	180	6 years

$$\text{Device A} = -600 - (600-250)\,(1+0.05)^3 + 100\left[\frac{(1+0.05)^6 - 1}{0.05(1+0.05)^6}\right] + 250\,(1+0.05)^6 = -208$$

$$\text{Device B} = -700 + 180\,(1+0.05)^6 + 100\left[\frac{(1+0.05)^6 - 1}{0.05(1+0.05)^6}\right] = -58.11$$

Select device B

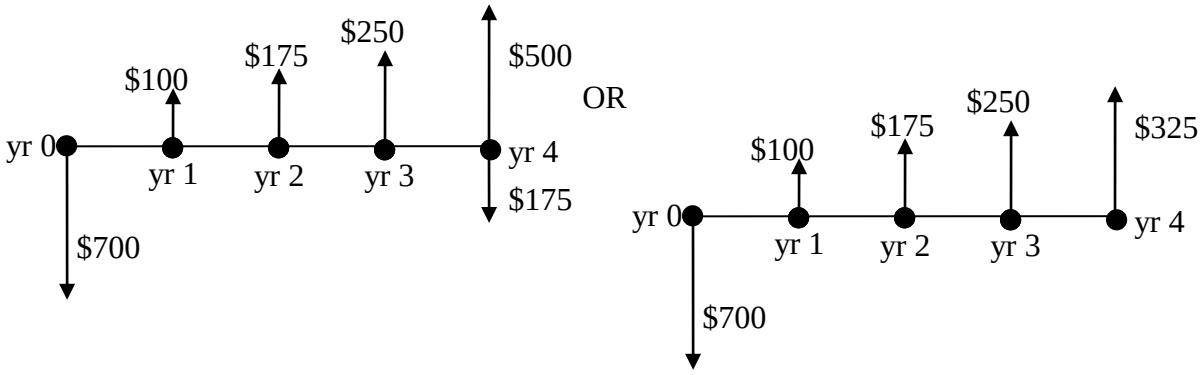
Q29. (5pts) You are purchasing a machine for $500 that will generate savings of $200 per year for each subsequent year. You estimate the machine has a 20% chance of lasting only 3 years of use, a 40% chance of lasting only 4 years of use, and 40% chance of lasting for 5 years. What is the expected NPV of the investment, assuming annual market rate of 8%?

0.2 * (200*(1.08^3-1)/.08/1.08^3-500)=3.08
0.4 * (200*(1.08^4-1)/.08/1.08^4-500)=64.97
0.4 * (200*(1.08^5-1)/.08/1.08^5-500)=119.42

Sum = $187.47

Can alternatively subtract out the $500 at the very end, instead of doing it for each scenario, since you'll always pay $500 for the machinery regardless of how long it lasts (and the probabilities sum to 1)

Q30. (5 pts) A 4 year investment includes the following cash flows: A $700 initial investment, a $100 cash flow on year 1, a $175 cash flow on year 2, a $250 cash flow on year 3, and a $500 cash flow with a $175 cleanup cost on year 4. **Draw** the cash flow diagram and **calculate** a rate of return that would result in a NPV of 0 for the investment (answer must be accurate +/-1%).



Either of the above diagrams is acceptable. **Cash flow arrows do <u>not</u> need to be drawn to scale**.

Finding the rate of return for NPV = 0 (i.e. internal rate of return):

$$NPV = -700 + \frac{100}{1+\text{IRR}} + \frac{175}{(1+\text{IRR})^2} + \frac{250}{(1+\text{IRR})^3} + \frac{500-175}{(1+\text{IRR})^4} = 0 \Rightarrow \text{IRR} = 0.069 = 6.9\%$$