

Engineering Systems Analysis for Design**Mid-Semester Quiz****October 26, 2003**

This is a closed book exercise. Computers and other wireless enabled devices for communication with web and outside are not allowed.

You may use old-fashioned, non-communicating calculators (if you have them).

Grade Tables

There are 90 points possible for the regular test, or 1 point per minute. Points associated with each question correspond to the estimated time it might take to answer them. There are also a possible 10 points of extra credit. Final scores will be based on 90 possible points.

Item	Score	
	Max	Yours
Your Name (provided we can read it)	1	
Concepts	22	
What's the best design?	15	
Static valuation of projects	13	
Decision Analysis and Value of Information	39	
Garage Example	10	
Total	100	
Percentage grade on basis of 90 maximum:		

I have completed this test fairly, without copying from others, a book, or the web.

Please sign your name legibly _____ (1 point)

Feedback voluntary question (no credit):

Suggest a CD or DVD for classroom enjoyment in second half of semester:

Concepts (22 points -- 2 points per part)

Write a short definition or description explaining the following:

Production Function

Technical Efficiency

Economic Efficiency

Isoquant

Returns to Scale

Economies of Scale

Expansion Path

Cost Function

Discount Rate

WACC

CAPM

What's the best design? (15 points)

You are given a production function: $4R^{0.45}S^{0.9}$

And the cost of the resources as: $2R^{0.4} + (4/3)S^{1.2}$.

[Note: $a^{(b)}$ means "a" raised to the power of "b"]

Note: In calculating answers, you may leave exponents in fractional form rather than estimating numbers in decimal form. For example, $(.4)^{2/3}$ would be acceptable.

a) What can you say immediately, by inspection, about the returns to scale? The economies of scale? Explain answer (3 points)

b) What is the optimal relationship between the resources R and S? (6 points)

c) What is the associated cost function? (6 points)

Static Valuation of Projects (13 points)

Consider the project with the following revenues and costs:

	Year				
	0	1	2	3	4
Revenues		633	760	900	1045
Costs	1000	300	400	500	600

Assume a discount rate of 10%.

a) Define Net Present Value and calculate it for this case (6 Points)

b) Define and Calculate the Pay Back Period (4 points)

c) What are the major advantages and disadvantages of the Benefit/Cost ratio as a criterion of evaluation? (3)

Decision Analysis (39 points)

It's March and you are trying to choose your post-graduation job. You have two offers:

- BIG company, an established organization that offers a 2-year contract with an annual salary of 80K, which could (Probability = 20%) provide a bonus of 20K at the end of any year.
- START UP that pays only 40K but, at the end of the year 1, gives you shares in the company if you sign up for the year 2. If the product works out well by the end of year 2 (probability = 20%) you could then cash in these shares and receive \$400K. If you do not sign up for year 2, you can go to MACJOB and get 50K for that year.

a) Draw the decision tree for this choice, giving all information provided. Which is the choice that maximizes expected value? (7)

b) You're concerned about the uncertainty associated with START UP, and are thinking about getting some extra information that would help you make your choice. Define the concept of the Expected Value of Perfect Information, and calculate its value for this case. (5)

c) You could organize a market study of START-UP's product before you decide which job to take. You would get a report that would assess it as either "great" or "poor". Graphically indicate how the decision tree in (a) should be altered to include this market test. (5)

d) Define Bayes' Theorem, explaining the meaning of the terms (4)

e) Given your initial assessment that the product has 20% chance of success, what is the probability that the market study will report that the product is "great". You assess that this study is inaccurate, only giving correct results 60% of the time [i.e, probability (study says 'great' if product will be success) = prob (says 'poor' if product will fail) = 0.6] (4)

f) Calculate how the test results would change your initial assessment of success? (8)

g) What is the expected value of the sample information? Is it worthwhile to buy the market survey? (6)

Garage Example (10 points, 2 per question)

Think back to the Garage and Satellite Examples presented in class and your latest assignment.

a) Under what circumstances is the value of a project, when calculated on the basis of the most likely forecasts, the same as its value when calculated for the range of possible scenarios that lead to those most likely forecasts?

b) Therefore, how likely is it that the valuation based on the most likely forecasts are correct?

c) What are the advantages of a staged approach that allows the designer to achieve a capacity through several increments, instead of one?

d) What are the disadvantages of the staged approach?

e) Illustrate how a staged approach could affect the Cumulative Distribution Function of the value of a project.