CA200 Information

1. Introduction

1.1 Course title

Quantitative Analysis for Business Decisions

1.2 Scheduled time-table

What?	When?	Where?
Practical (& Tutorial)	Monday, 15.00-17.00	L101
Lecture	Monday, 10.00-11.00	Q121
Lecture	Thursday, 16.00-17.00	Q122

Note: For first few weeks, check on the time-table in case of changes.

1.3 How assessed?

Examination	Continuous Assessment
75%	25%

1.4 Some examples of kinds of problems dealt with

These examples are to give an idea of what to expect on the module, and to lead into the list of specific topics to be covered (section 1.5).

1.4.1 Example 1 (Use of Probability)

From past experience it is known that a machine is set up correctly on 90% of occasions. If the machine is set up correctly then the conditional probability of a good part is 95% but if the machine is not set up correctly then the conditional probability of a good part is only 30%.

On a particular day the machine is set up and the first component produced and found to be good. ***What is the probability that the machine is set up correctly?*** [*The answer turns out to be 0.966*]

1.4.2 Example 2 (Use of Probability, Expected Value in making a decision)

A distributor buys perishable goods for €2 per item and sells them at €5. Demand per day is uncertain and items unsold at the end of the day represent a write-off because of perishability. If the distributor understocks then he/she loses profit that could have been made.

A 300-day record of past activity is as follows:

Daily demand (units)	No. of days	P (probability)
10	30	0.1 (= 30/300)
11	60	0.2 (= 60/300)
12	120	0.4 (= 120/300)
13	90	0.3 (= 90/300)
Σ (column sums)	300	1.0

What level of stock should be held from day to day to maximise profit? [*The answer turns out to be 'to stock 12 units per day'*]

1.4.3 Example 3 (Use of Decision Trees)

A firm has developed a new product (called X). Now, they can either test the market or abandon the project. The details are set out below.

Test market costs = €50,000; likely outcomes are favourable (P=0.7) or failure (P = 0.3). If favourable, the firm could either abandon or produce it where demand is anticipated to be

Low	P = 0.25	**Loss**	€100,000
Medium	P = 0.6	**Profit**	€150000
High	P = 0.15	**Profit**	€450,000

If the test market indicates failure, the project should be abandoned.

Abandonment at any stage results in a gain of €30,000 from the special machinery used.

What should the firm's decision be? [*Answer: Test the market and produce only if there are favourable indications*]

1.4.4 Example 4 (Statistical Inference)

A random sample of 400 rail passengers is taken and 55% are in favour of proposed new timetables.

With 95% confidence what proportion of all rail passengers is in favour of the timetables?

[*Answer: 95% confident that the population proportion in favour is between 0.501 and 0.599*]

1.4.5 Example 5 (Linear Correlation and Regression)

The following data have been collected regarding sales and advertising expenditure:

Advertising Expenditure (€'000)	210	250	290	330	370	410
Sales (€'m)	8.5	9.2	7.9	8.6	9.4	10.1

(a) **Plot the data on a scatter diagram and, using judgement, decide whether there is a correlation between sales and advertising expenditure.**

(b) **Calculate r^2 where r is the correlation coefficient and say how your answer of part (a) compares with this numerical measure of correlation.** [*Answer is that $r^2 = 0.41$ which means that factors than advertising explain 1 - .41 = 0.59 or 59% of variations in sales.*]

1.4.6 Example 6 (Linear Programming)

A company employs two grades of quality control inspector to examine pieces being produced on a production line. A grade one inspector can inspect at the rate of 25 pieces per hour, with 98% accuracy and for this they are paid €16 per hour. Grade two inspectors inspect pieces at the slower rate of 15 per hour and with 95% accuracy, and they are paid €12 per hour. The company can call on up to eight grade one inspectors and up to 10 grade two inspectors, but inspectors who are not called upon do not have to be paid. Any errors which are made in the inspection process cost the company €8 each. The company requires that at least 1800 pieces must be inspected each day (8 hours).

How many grade one inspectors and how many grade two inspectors should the company call on? [*Answer: Employ 8 (the maximum) Grade 1 inspectors and 5/3 Grade 2 inspectors – this is a "mathematical" answer as in practice, one might need to call up a whole number!*]

1.4.7 Example 7 (Inventory Control)

A company requires 26,000 cases of CDs per annum, the demand being essentially constant throughout the year. The cost of placing an order is €130, regardless of the order size and the company pays €4.50 per case. The holding cost is estimated to be €0.10 per unit per month.

What size of order should the company place when it is placing an order, and how many orders per year should the company place? [*Answer: The order size should be 2372 and, therefore, there should be 11 orders per year (one of them being slightly less than 2372 or perhaps the company will actually obtain 11 x 2372 = 26092 which is slightly more than required*]

1.4.8 Example 8 (Simple Queue Theory)

A computer lab has three printers which can each print an average of five jobs per minute. The average number of jobs entering a single queue for the three machines is twelve per minute. Assuming the queue is M/M/3 [*multi-server queue – 3 servers = printers here*] calculate the following:

(i) **The average time a job is in the system** [*Answer: 0.42 minutes*]

(ii) **The average number of jobs in the system** [*Answer: 4.99 jobs*]

(iii) **Whether any time would be saved for the customers if the three slow printers were replaced by one fast printer, working at 15 jobs per minute.** [*Answer: New system would be faster*]

1.5 Indicative list of topics making up the course

There are two main parts though we may need to spend more time on the first:

Part I: Probability and Statistics [using SPSS or R a good deal**]**

- Probability and Decision Making
- Decision Trees
- Statistics – Introduction
- Statistical Inference
- Hypothesis Testing
- Linear Correlation & Regression

Part 2: Operations Research methods [will not cover all topics**]**

- LinearProgramming (formulation, graphical soln., possible other tools - **AMPL**)
- Inventory Control (introduction/example)
- Simulation – by example
- Application of basic Queue Theory results – by example

Notes:

(1) Coverage/tool base may vary compared to previous years.

(2) The order of presentation might change w.r.t. above. For example, we might be working on one topic in the lab practicals and a different one in lectures.

1.6 What software tools (on lab machines) you can learn to use?

- **SPSS** (*originally, Statistical Package for the Social Sciences*)

[*There are various books, which may be helpful, on this in the DCU library, such as Marketing research with SPSS by Janssens, Wim (658.830285555/JAN); some are quite old as package now at Version 17 or so!. There is a good integrated tutorial*]

- **AMPL** (*A Modelling Language for Mathematical Programming*)

[*You **may** wish to just use this in an introductory way; for those interested -the student edition software can be downloaded for free, see* http://www.ampl.com/DOWNLOADS/index.html]

- **R** *statistical software (will definitely use and will support in labs.)*

Notes:

(1) Suggestion: for background, search the internet for information on the above tools.

(2) It is understood that Microsoft Excel was learned in first year and this can be used effectively as a general purpose tool for quantitative analysis, if a bit limited.

1.7 Some references

Browse in DCU library for books such as the following,

- Mark Berenson and David Levine, **Basic Business Statistics**, Prentice hall – various editions in DCU library (e.g. 519.502465/BER).

- Curwin, Jon; Slater, Roger, **Quantitative methods for business decisions** – various editions in DCU library (e.g. 658.4033/CUR)

- *Taha, Hamdy A* , **Operations research: an introduction** – various editions in DCU library (e.g. 003/TAH) [*Don't be put off too much by mathematical details*]