# ASSIGNMENT

**This is an individual assignment** and accounts for 100% of the final module mark. The assignment consists of three sections, Section A, Section B and Section C. To pass, you will need to answer the questions in all three sections (attempt all parts), and it should obviously all make good sense!

**The Intended Learning Outcomes of the Assignment are:**

* To introduce to the student the fundamental concepts which can be used to understand and improve the process of decision-making.
* Use appropriate statistical methods to analyse a variety of financial decisions.
* Improved literature review skills.

# Section A – Multicriteria Decision Analysis

The task of this part is to model, or analyse, a decision (or decisions) using:

*Multi-Criteria Decision Analysis.*

The purpose of your model or analysis should be to enable the decision to be made more effectively, so that the outcome is better than it would otherwise have been.

It is important that your decision should be a realistic one. As far as possible, the data (costs, criteria, weights, etc.) you use should be genuine. Where this is not possible, you should explain how you would obtain the information.

*You should discuss your proposed model with your course tutor. Your course tutor will be marking the assignment, so it will be easier and helpful if you get their approval. This is to reduce the likelihood of misdirected work.*

You should submit a written account of your model or analysis. This should include (not necessarily in this order):

* Details of the decision maker(s) and the decision(s).
* Details of the recommendations you would make to the decision maker.
* An explanation/description of your model or analysis. This should make it clear how the model works. You should also submit all relevant spreadsheet files.
* The source of any information (costs, criteria, etc.) incorporated in the model or analysis.
* An evaluation of the model or analysis. This should include a critical analysis of any assumptions, and comments on the usefulness of your analysis.
* References to books, articles, etc. that you make use of.

To pass, you will need to submit everything listed above - and it should obviously all make good sense! In addition, other things being equal, we will give more credit to ambitious projects than to very simple ones. To get a good mark, you should:

* Do everything listed above, and
* Pay particular attention to the evaluation of your model, the analysis of its assumptions, and the source of the information it incorporates.

*Some suggestions*

These are suggestions only (we are prepared to be *very* flexible regarding what is acceptable, but please check with us before going ahead if you are in any doubt):

* Potential business decisions: e.g. on your proposed dot.com or other business.
* Business decisions: only viable if you work for a business or have good access to information from a business.
* Personal decisions: e.g. on purchases or rental of a car or a house, on choices of courses or careers, on investments, and so on. It may be appropriate to build a model that will be helpful for *any* person having to make these decisions, or you may just be considering a single decision maker.

Your report for Section A must not materially exceed 1,300 words in length.

# Section B – Statistics and Regressions

The task is to model, or analyse, the following case study:

A manufacturer wants to analyse the relationship between sales and the amount spent on advertising on television, in magazines, and on the radio. The table below shows the amount spent on these three types of advertising and the sales for each of ten randomly selected sales months. All figures are in millions of pounds.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Month | Television Advertising  Expenditure | Magazines Advertising  Expenditure | Radio Advertising  Expenditure | Sales |
| 1 | 8.2 | 4.3 | 6.0 | 361 |
| 2 | 6.2 | 4.1 | 4.8 | 340 |
| 3 | 9.7 | 5.7 | 6.4 | 379 |
| 4 | 9.1 | 3.1 | 6.0 | 369 |
| 5 | 10.4 | 2.6 | 5.1 | 366 |
| 6 | 9.0 | 3.7 | 5.0 | 365 |
| 7 | 9.1 | 4.0 | 6.0 | 373 |
| 8 | 10.7 | 4.3 | 6.3 | 379 |
| 9 | 9.4 | 4.2 | 5.4 | 362 |
| 10 | 10.3 | 6.1 | 5.9 | 388 |

*(All figures are in millions of pounds. So, for example, a value of 8.2 in the Television Advertising Expenditure column would mean an expenditure £8,200,000 whereas a value of 361 in Sales column would mean sales of £361,000,000)*

You are required to analyse the data above using Microsoft Excel. For parts (c-e) below, do not use the standardised Excel functions – instead you may use Excel to apply the relevant formulas learnt in the course. Specifically, you should answer the following questions:

1. Use Excel to construct a histogram to show the distribution of Sales (you will need to choose suitable class intervals).
2. Discuss whether this distribution is normal.
3. Calculate the quartiles of the Sales distribution and its inter-quartile range. Explain the meaning of the lower quartile (Q1) and the inter-quartile range in the context of the example data.
4. Calculate the values of both Kendall’s and Pearson’s correlation coefficients between Sales and Television Advertising Expenditure. Explain the meaning of a correlation coefficient in the context of the example data.
5. Calculate the standard deviation of Sales, Television Advertising Expenditure, Magazine Advertising Expenditure, and Radio Advertising Expenditure. Explain the meaning of the standard deviation in the context of the example data.

Now do a regression analysis using the Excel Regression Tool with Sales as the dependent variable, and Television Advertising Expenditure, Magazines Advertising Expenditure, and Radio Advertising Expenditure as the independent variables.

1. Suppose a new advertising campaign is proposed with a budget of £11m allocated to Television Advertising, £6.5m allocated to Magazine Advertising, and £7m allocated to Radio Advertising. What will be the expected sales from this new campaign?
2. What conclusions can be drawn from the regression analysis about the effect of Television Advertising Expenditure and Magazine Advertising Expenditure on Sales? (You may find the regression coefficients in the regression output table helpful).
3. What does the R Square value indicate about a regression model?
4. Explain the meaning of the numbers in the *p-value* column of the regression output. Which of the results are significant at the 5% significance level? Outline whether any results are significant at the 10% significance level and explain the impact of a higher significance level on your conclusions.
5. Discuss the benefits and difficulties of using multiple regression (you can refer to the results obtained in this example if you wish).
6. Without applying any additional analysis to the data, discuss what recommendations for further analysis you would suggest to enhance your conclusions/analysis.

Your report for Section B must not materially exceed 1,400 words in length.

# Section C – Monte Carlo Simulations

Glaxco plc, a major pharmaceutical company, is considering developing one of two mutually exclusive drug products. Product A requires an immediate investment of £2.5m and Product B requires £2m. Both products will have a life of three years. If there was no inflation, then the demand (in units), price (per unit sold), and the relevant production costs (total) for the three-year life of each of the products would be:

|  |  |  |
| --- | --- | --- |
| Item | Product A | Product B |
| Demand | 2,100,000 units | 1,900,000 units |
| Price | £1/unit | £1/unit |
| Materials | £800,000 | £200,000 |
| Labour | £300,000 | £700,000 |
| Overheads | £100,000 | £50,000 |

The cash flows for each product are estimated as revenues minus costs. These cash flows can be assumed to arise at the year-ends of each of the three years. Specific annual inflation rates have been estimated for each of the cash flow elements:

|  |  |
| --- | --- |
| Demand | 5% |
| Materials | 4% |
| Labour | 10% |
| Overheads | 7% |

Furthermore, the total demand, materials, labour, and overheads for each product were estimated using various pieces of information. The demand for each product, for example, may not be precisely as estimated above because of various uncertainties. For this reason, they decided to use probability distributions to allow for a range of possible values for the above variables. The associated distribution for each variable and the parameters for each probability distribution are given in the following tables:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Triangular Distribution | | |  |  | Pert Distribution | | |
| Demand (units) | Min | Most likely | Max | Materials (£m) | Min | Most likely | Max |
| Product A | 1.9 | 2.1 | 2.3 | Product A | 0.6 | 0.8 | 1.0 |
| Product B | 1.5 | 1.9 | 2.3 | Product B | 0.1 | 0.2 | 0.3 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Discrete Probability Distribution | | | | | | | |
| Labour (£) | Product A | | | | Product B | | | |
| x-values | 200,000 | 300,000 | 400,000 | 500,000 | 500,000 | 700,000 | 800,000 | 900,000 |
| p-values | 0.3 | 0.5 | 0.1 | 0.1 | 0.3 | 0.5 | 0.1 | 0.1 |

|  |  |  |
| --- | --- | --- |
|  | Normal Distribution | |
| Overheads (£) | Mean | Standard Deviation |
| Product A | 100,000 | 5,000 |
| Product B | 50,000 | 1,000 |

Finally, the cost of capital is 17 per cent per annum. However, there is a 20% probability that the company will take a loan to finance the development of the products. If that happens the cost of capital will drop to 16 per cent per annum.

1. For the situation described above, develop first a deterministic model for the Net Present Value (NPV) of each product. Use then the information provided for the uncertain variables to run a Monte Carlo simulation and present the results in relevant diagrams (you should at least have two graphs, each showing the simulated distribution of the NPV for each product).
2. Discuss the recommendations you would make to the management of Glaxco on the basis of these diagrams.

1. Discuss the advantages of using Monte Carlo simulation instead of a deterministic analysis.

Your report for Section C should not materially exceed 1,300 words in length.

## Hand-in Date

Any supporting files you wish to submit (such as Excel files, Expert Choice files etc.) must be submitted via the relevant for the assignment Moodle dropbox.

## Word Count

The coursework word count is a **MAXIMUM OF 4,000 WORDS** (THERE IS NO ±10% MARGIN) excluding reference list, bibliography, appendices, the cover page, abstract, glossary and list of tables, figures, charts and abbreviation. Tables are expected to be primarily for the presentation of numerical data. Work that exceeds 4,000 words will not be read beyond the stated word count.

The word count should be stated at the top of your submission. A falsely stated wordcount is an assessment offence, which will be referred to PBS Student Assessment and Assessment Regulations Lead.

## Formatting

The work should be word processed. Font size should be between 12 and 14 and ‘easy to read’ e.g. Calibri, Arial, Times New Roman. Line spacing should be between 1.5 and 2 with (approx.) 4 cm margins all round. The Header must include the student number and the Footer must include a page number. There are no extra marks for excessive presentation; for example elaborate graphics on the cover sheet.

**Written Report**

Your report should contain:

1. A **clear summary** of your results.
2. A **brief and clear** explanation of how you carried out the calculations.
3. A **critical discussion** of your results and conclusions.

The requirements (1), (2) and (3) are very important. Make sure you try to achieve these in your written report.

For example, using clearly presented tables to summarise your results in (1) is good. Spending pages and pages describing in detail what the reader can clearly see from the tables is bad.

If you write a poorly structured report with a bunch of spreadsheets/printouts attached at the end, it is very difficult for the examiner to know what your results are, whether you have carried out the calculations correctly, what your conclusions are, and in general, whether or not you understand what you are doing.

Your aim in writing your report must be to convince the reader that you have complete confidence in applying these techniques, that you understand the ideas behind these applications, and that you can critically discuss the results and form reasonable conclusions.

## Your Report Should

* Be written in a plain style, using subheadings and lists where appropriate.
* Be properly referenced acknowledging all the sources you have used, and only the sources you have used.
* Include evidence of locating and reading sources beyond the suggested initial reading.

## Referencing Requirements

All sources should be acknowledged and appropriately cited within your work, following the University's approved referencing conventions [APA 6th ed.].

Referencing is required to give intellectual credit to your source, help your reader recover your source easily and to avoid being accused of plagiarism.

Students are reminded that the University will not tolerate academic dishonesty in any form.

Please include a Reference List of all items cited in your work and follow this with a Bibliography to show your wider background reading.

Further guidance on report writing, referencing as well as links to useful websites are on the Statistics and Data Modelling Moodle site

## Marking Scheme

Section A 30 marks

Section B (40 marks)

|  |  |
| --- | --- |
| Part (a) | 3 marks |
| Part (b) | 3 marks |
| Part (c) | 3 marks |
| Part (d) | 4 marks |
| Part (e) | 4 marks |
| Part (f) | 3 marks |
| Part (g) | 4 marks |
| Part (h) | 4 marks |
| Part (i) | 4 marks |
| Part (j) | 4 marks |
| Part (k) | 4 marks |

Section C (30 marks)

Part (a) 15 marks

Part (b) 5 marks

Part (c) 10 marks

Total 100 marks

## Marking and Feedback

## Table 1: Marking Criteria – Essay/Report Type

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component and Suggested Marks** | **Failure < 40%** | **Pass**  **40 – 55%** | **Good Pass 56 – 69%** | **Distinction >70%** |
| **Introduction and background to**  **topic** | Limited introduction not focussed on aims of assignment | Topic well focussed but introduction and context incomplete | Introduction clearly expressed; context well defined | As for good pass |
| **Understanding of**  **key issues** | Minimal understanding of key issues | Main issues largely identified, but some lack of focus | All issues clearly  understood, with **some**  differentiation in  terms of importance | Issues clearly understood and differentiated in terms of  importance |
| **Evidence of reading and/or choice of**  **appropriate**  **concepts** | Little evidence of reading or limited /inappropriate use of module material; unclear theoretical framework; important work uncited or key concepts ignored | Evidence of reading or appropriate use of module material but with some gaps. Literature /concepts adequately but not critically reviewed. | Good critical literature review or well-justified choice of module material. Theoretical framework supports study. | Demonstrates high level of scholarship. |
| **Analysis** | Largely descriptive; practically no analysis of central issues. Qualitative or quantitative data analysis inaccurate. | Some critical analysis of central  issues, but with some inaccuracies. | Relevant and full analysis | Comprehensive  and critical analysis of central issues. |
| **Presentation and evaluation of evidence** | Some evidence to support  arguments but uncritical acceptance of material; poor or  incomplete citation; unjustified conclusions. | Appropriate evidence, generally  assessed  critically; weak interpretation of qualitative aspects; some gaps in linkages between evidence and conclusions. | Full, critical  assessment of discriminatingly selected material; some evidence of independent thought | Full, critical  assessment of discriminatingly selected material; evidence of independent thought; substantial individual insights evident |
| **Presentation: Structure, clarity, use of grammar,**  **correct spelling** | Poor: lack of  structure and clarity;  grammatical mistakes; inadequate referencing | Reasonably clear presentation; reasonable referencing; few grammatical/spelli ng mistakes | Demonstrates very good  communication skills; accurate referencing; very few/no grammatical or spelling errors | Excellent communication skills; accurate referencing; virtually no errors; scholarly, well-organised treatment of material |
| **Attainment of learning**  **objectives** | Attainment of few/none of the relevant learning objectives | Attainment of a good majority of the relevant learning objectives | Attainment of substantial majority of the relevant learning objectives | Attainment of nearly all of the relevant learning objectives |

## Table 2: University of Portsmouth General Grading Criteria for Level 7 & 8

|  |  |
| --- | --- |
|  | **Level 7 & 8** |
| **80+** | As below plus:   * Excellent work – able to express an original reasoned argument in a lucid manner by reviewing and critiquing a wide range of material. Original, critical thinking based on outstanding insight, knowledge and understanding of material. Material contributes to current understanding and is of potentially publishable quality in terms of presentation and content. * Wide reaching research showing breadth and depth of sources. |
| **70-79** |
| **60-69** | As below plus:   * Clear, balanced coherent critical and rigorous analysis of the subject matter. Detailed understanding of knowledge and theory expressed with clarity. * Extensive use of relevant and current literature to view topic in perspective, analyse context and develop new explanations and theories. |
| **50-59** | As below plus:   * Detailed review and grasp of pertinent issues and a critical contextual overview of the literature. Thorough knowledge of theory and methods and uses this to underpin arguments and conclusions. * Confidence in understanding and using literature. |
| **40-49** | * Demonstrates grasp of key concepts and an ability to develop and support an argument in a predominately descriptive way with valid conclusions drawn from the research. * Familiarity with key literature which is cited and presented according to convention. * Logical and clear structure, well organised with good use of language and supporting material |
| **30-**  **39** | **FAIL** – Some knowledge of relevant concepts and literature but significant gaps in understanding and / or knowledge. Little attempt at evaluation, conclusions vague, ambiguous and not based on researched material. Limited or inappropriate research. Deficits in length, structure, presentation and / or prose. |