Module Code  ST1004

Module Name  ST1004 INTRODUCTION TO MANAGEMENT SCIENCE

ECTS weighting  10

Semester/term taught  Semester 1 and 2

Contact Hours  3 Lectures per Week.

Module Personnel  Lecturers - Dr Arthur Hughes & Mary Sharp

Learning Outcomes  Learning Outcomes - Semester 1:

1. When students have successfully completed this module they should:

2. Set up a two-variable linear programming problem, solve it using the graphical method, and recognise if there is no solution, it is unbounded or if there are multiple solutions.

3. Solve probability based problems using the laws of probability including the partition law and Bayes law and the Expected Value of a random variable.

4. Identify the three components --- actions, states of nature and consequences --- of a decision problem and use them to construct a decision table and tree.

5. Solve a decision problem using the ideas of maximim, Hurwicz, regret and Laplace’s indifference.

6. Solve a decision problem under uncertainty using the principle of maximising expected value or expected utility, and be able to compute the value of perfect and imperfect information in that problem.

7. Be able to construct and solve a decision tree for decision problems involving a sequence of actions and states of nature.

8. Explain why money has decreasing marginal worth and why a concave utility function models it.

9. Explain risk averse and risk prone behaviour, give examples of each and demonstrate that decreasing marginal worth leads to risk averse behaviour.

10. Calculate properties of a queue from information about number of servers, arrival rates and service rates.

11. Identify and solve problems using dynamic programming.

Learning Outcomes - Semester 2:

When students have successfully completed this module they should:
12. Explain why the value of money decreases as a function of how far in the future it will be available.

13. Explain how partial compounding can lead to confusion over the real amount of interest being charged on a loan.

14. Compute the simple and compound interest of any amount of money, the value of an annuity and the payment of an amortised loan.

15. Compute the shortest spanning tree of a network and the shortest path between two points in a network.

16. Construct the network representation of a project and compute its critical path.

17. Derive the maximal flow through a network.

18. Compute the optimal inventory policy for the classic formulation, and also with constant receipt and shortages. Identify the four feature of a time series.

19. Make a prediction for the next value of a time series using moving average and exponential smoothing.

Module Learning Aims

This module covers a range of subjects in management science at an introductory level. The objectives of the module are to give students an overview of the subject, to teach important basic techniques and introduce systematic thinking about problems. The first semester starts with an introduction to problem solving and models and moves on to cover the time value of money, classic network problems, inventory control and time series forecasting and graphical linear programming. The second semester develops ideas in linear programming and introduces the simplex method. It will cover the basic transportation and allocation algorithms and introduce the basic ideas of game theory and decision analysis. The module will combine lectures and tutorials. The module will combine lectures and demonstrations of mathematical solutions to management science problems.

Module Syllabus - Semester 1:

- Linear programming: problem, graphical solution.
- Decision analysis: components of a decision, decision tables and trees, decision criteria, decision making under uncertainty, value of information, the utility of money (risk averseness and decreasing marginal worth).
- Queues: M/M/1 and M/M/n queues.
- Dynamic Programming: the knapsack problem, the allocation problem, general principle of dynamic programming.

Module Syllabus - Semester 2:

- Time value of money: interest, net present value, annuities, amortised loans, futures.
- Networks: spanning tree, shortest path, critical path analysis, maximum flow
algorithm.
- Inventory control: the classic model, constant receipt, shortages.
- Time series: properties of time series, moving averages, exponential smoothing
- Transportation problem: definition, balanced problems, algorithm, initial solutions.

**Recommended Reading List**

**Assessment Details**
- Annual examination = examination script (80%) + course work (20%).
- Supplemental examination = examination script only (100%).

**Academic Year of Data**
- 2014/15