UNIVERSITY OF KARACHI
DEPARTMENT OF COMPUTER SCIENCE
(MORNING / EVENING PROGRAMME)
MASTERS IN COMPUTER SCIENCE (PREVIOUS)
FIRST SEMESTER 2021
COURSE-OUTLINE AND POLICIES FOR THE COURSE
CS-507 LINEAR PROGRAMMING

RECOMMENDED TOPICS
Introduction to Operations Research. Background and relevant issues. Review of the terms used in Operations Research. Operation Research models.
Basic Linear Algebra concepts. Matrices and vectors. Systems of linear equations. Linear independence and linear dependence. Determinants.
Equalities and inequalities. Optimisation techniques for various models. Objective functions, constraints and other restrictions.
Introduction to linear programming model. Single-answer and multi-answer problems. Graphical solutions to the linear programming problems. Observations and graphical solutions. Uniqueness of solutions.
Various business models. Generating Operations Research and Linear Programming models for various business models and problems.
Representation of problems in standard form. Domain and constraints of the problems. Non-negativity constraints.
Gauss-Jordan elimination process. General procedure and test for inconsistency. Simplex method. Simplex criterion. Degeneracy cases. General procedure. Basic solutions.
Phases of simplex method. Initial basic feasible solution. Two-phase process.
Duality theorem. Construction of the dual. Equality constraints. Economic interpretation of the dual. Sensitivity analysis.
Various applications of linear programming. Transportation model. Linear production model. Critical path scheduling. Allocation problem.
Introduction to goal programming. Introduction to integer linear programming.
Introduction to deterministic inventory models. Introduction to forecasting models.

Overview of the course:

Critical study of Linear Programming model, one of the advanced and applied topics in the field of Management Sciences and Mathematical Algorithms known as Operations Research. Topics include Linear Programming modelling, optimisation problems, solving optimisation problems using linear programming algorithms using graphical and Simplex methods, an overview of some advanced topics such as assignment and allocation problems, network problems, and Enterprise Resource Planning (ERP) etc. Substantial projects including mathematical modelling of the real life problems and their mathematical models based solutions are the vital part of the course.

Type of the course:

This is a compulsory course for the students of Masters in Computer Science programme. A very good understanding of mathematics, an advanced level of computer programming or equivalent course, and design and analysis of algorithms or equivalent course along with a vital experience of computer programming and business problems are preferred for the students registering for the course.

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Objectives of the course:

This course enables the students to critically understand mathematical modelling of the real life problems including business and finance problems. This course also helps the students understanding and implementing the better solutions for the business problems including minimisation/maximisation or optimisation problems. This course enables the students to understand the quantitative issues of Enterprise Resource Planning (ERP). This is an important course in the academic programmes of a large number of universities world-wide for the students of Computer Science, giving an exposure to the real-life problem solving skills empirically.

Recommended text books:

- **Operations Research. By: Hamdy A. Taha. Pub: Prentice-Hall Private Limited. (Latest edition)**

Recommended reference books and materials:

- **Any text book available in the University library preferably or available in the local market for the topics mentioned above.**
- **At the time of discussion of a topic, relevant books/materials may be referred from time to time.**

Examination policy:

The examination policy is subject to the rules and regulations of the University, and hence can be reviewed at any time as per policy of the University.

Quizzes, midterm and assignments will be conducted during the course accordingly. All submitted works in the form of class assignments and home-work assignments must be on A4-size page(s). No work will be accepted unless it is submitted as per instructions accordingly.

It will be responsibility of the students to keep themselves up-to-date regarding the assignments. No excuses will be accepted regarding non-submission of any assignment due to absence; submission of assignments will remain due in such cases.

It will be mandatory for the students (on individual basis) to work on the project and to prepare the project report, which will be examined during or before the final examination week. It will be necessary for the students to qualify in both theory examination and project/practical examination in order to qualify for the course. Topics for the final projects must be finalised not later than one week from this notification.

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Attendance policy:

Attendance in the course is mandatory (please refer to the university rules and regulations for further information regarding attendance policy).

Scholastic ethics:

Copying of somebody else's work and/or claiming somebody else's work to be your own work and/or any other similar types of activities during quizzes, examinations and while preparing the assignments and/or project reports are considered to be one or the other forms of cheating. These types of activities are strictly against the scholastic ethics, and are strictly prohibited in the university. Any activity which is against the scholastic ethics might disqualify you from the course and sometimes from the whole academic programme. Please be very much careful.

Scheduled class timings and Counselling hours for the course:

- **As per departmental schedule (and/or as announced)**

Teaching Assistant(s) for the course:

- **To be announced later**

Final project reports for the course:

It is mandatory for the students to work on a relevant project and to prepare the academic report of the work done during the project on individual basis. In this regard, the formal proposals should be prepared and submitted within one week from this notification. The proposals should consist of: Preliminary objective (task); Problem definition and description; Idea and theory behind the problem and its solution; Suggested solution / method etc; Potential in the desired work; Suggested plan for study.

Selection of the topic for the project is also a part of the project. Students are recommended to go through various resources for this task.

The final project reports, individually worked out and submitted, should consist of: Main objective; Exact problem definition; Detailed relevant analysis of the problem; Detailed background theory; Higher-level detail design; Suggested solution/ methods/algorithms/methodologies etc; Software system along with the input data and the output result/Pseudocode algorithm along with the dry execution and the trace table, as the case may be (as and where applicable); Implementation/testing strategy (as and where applicable); Results/findings/outcomes (as and where applicable) along with the conclusions; Future work recommendations; Bibliographic references. The project reports completed in all aspects must be submitted during the last week of the course, prior to the commencement of the final

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examination. Individual defence of the report and oral examinations will be conducted at the time of submitting the reports.

Following are some of the suggested topics that may be selected as the final project for the course. However the students may decide to work on the project of their own choice as already mentioned above (subject to the approval of the course incharge).

#	SUGGESTED TOPICS
1	Decision making under certainty and uncertainty.
2	Work scheduling problem and its linear programming solutions.
3	Capital budgeting problem and its linear programming solutions.
4	Financial planning problem and its linear programming solutions.
5	Probabilistic inventory model.
6	Inventory models and their linear programming solutions.
7	Using linear programming models for Enterprise Resource Planning (ERP).
8	Economics issues and linear programming solutions.
9	Forecasting models and the linear programming solutions.
10	Special cases in linear programming models.

Important note:

It will be responsibility of the students to keep themselves up-to-date for the course in all circumstances, and to know the maximum number of absences they are allowed as per university rules. The contents of the course, examination policy and the counselling hours, stated above, are subject to change, addition and/or modification from time to time, at the discretion of the course incharge, for the betterment of the students and the institution, and no claims will be entertained regarding that in any circumstances, whatsoever. The list of topics given above might be covered completely, however, the topics might be selected adaptively based on the background interest of the individuals and the rate of progress.

On getting registered for the course, you accept to follow all the regulations stated herein for the course.

Electronic links for the course:

- **Google Classroom:**   As announced.
- **Usergroup:**   To be announced later.
- **Website:**   To be announced later.

Dr. Syed Jamal Hussain