School of Science
The University of Jordan

Integer and Combinatorial Optimization | Course outline

Course code and name: 0301973 Integer and Combinatorial Optimization
Credit hours: 3
Prerequisite: None
Teaching Language: English

Instructor Name	Dr. Baha Alzalg
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Office hours	TBD
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Course Description:
Theory and applications of integer and combinatorial optimization including enumerative, cutting plane, basis reduction, relaxation and matching methods.

Course Aims and Outcomes:
A- Aims:

1. Develop a fundamental understanding of integer programming models.
2. Able to develop an integer programming model from a problem description.
3. Provide a detailed treatment of the theory of integer and combinatorial optimization.
4. Learn solution methods for integer and combinatorial optimization.
5. Describe applications of integer and combinatorial optimization.

B- Intended Learning Outcomes (ILOs):

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding Skills: Student will be able to

A1) State the theories and concepts used in integer programming.

A2) Identify the steps required to carry out a piece of research on a topic with in the field of integer and combinatorial optimization.

A3) Recognize the contribution and impacts of integer and combinatorial optimization in scientifically, economic, environmental and cultural terms.

B. Intellectual Analytical and Cognitive Skills: Student will be able to

    B1) Apply appropriate theories, principles and concepts relevant to integer programming.

    B2) Assess the literature within integer and combinatorial optimization.

    B3) Demonstrate a reasoned argument to the solution of familiar and unfamiliar problems relevant to integer programming.

C. Subject- Specific Skills: Student will be able to
    C1) Plan and design applications using techniques and procedures appropriate to integer programming.

    C2) Plan and design a piece of independent research using integer programming techniques.

D. Creativity /Transferable Key Skills/Evaluation: Student will be able to

    D1) Deal with an appropriate effective data relevant to integer programming.

    D2) Solve problems relevant to integer programming using ideas and techniques some of which are at the forefront of the discipline.

Teaching methods:

Development of ILOs is promoted through the following teaching and learning methods:

The instructor will spend most of the class time on presenting the new material as well as on discussing the new ideas and techniques with the students.
To actively participate in class, students need to prepare before class by reading the textbook and doing all assigned problems before class.
Students should be prepared to discuss their homework at each class meeting.
Students are encouraged to work together with other students and to ask questions and seek help from their professor, both in and out of class.

Tests & evaluations:
Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	Exams and Assignmens	To develop the necessary skills to do independent and original research

Topic Outline and Schedule:

The following is a rough plan. As the course progresses, I may include new topics and/or delete some of the ones listed here.

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
1. Integer programming basics and formulations.	1-3	Dr. Baha Alzalg		Exam/ Assignment	25 A
2. Enumerative methods - branch-and-bound.	4-5	Dr. Baha Alzalg		Exam/ Assignment	25 A
3. Theory of valid inequalities.	6-7	Dr. Baha Alzalg		Exam/ Assignment	25 A
4. Lattices and applications.	8-9	Dr. Baha Alzalg		Exam/ Assignment	25 A
5. Algebraic geometry techniques.	10	Dr. Baha Alzalg		Exam/ Assignment	25 A
6. Computational complexity.	11	Dr. Baha Alzalg		Exam/ Assignment	25 A
7. Integral polyhedra, matching, other topics.	12-16	Dr. Baha Alzalg		Exam/ Assignment	25 A

Text book:

Dimitris Bertsimas and Robert Weismantel. *Optimization over Integers*, Dynamic Ideas, ISBN: 0-9759146-2-6.

References:

1. Laurence A. Wolsey. *Integer Programming*. John Wiley and Sons, ISBN: 0-471-28366-5.
2. Hamdy A. Taha. *Integer Programming: Theory, Applications, and Computations*. Academic Press. ISBN: 9781483260372.

Important regulations:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.

2. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.

3. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.

4. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.

5. Solutions for the exams will be posted at the teaching webpage of the instructor: http://sites.ju.edu.jo/sites/alzalg/pages/teaching.aspx

6. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home works.