

UNIVERSIDAD AUTÓNOMA DE NUEVO LEÓN  
Facultad de Ingeniería Mecánica y Eléctrica

Homework 1

Due date: Mon 05-Feb-2024 18:00

Course: **Selected Topics on Optimization**

Semester: Spring 2024

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**Answer each question.**

1. Formally define an optimization problem.  
**It is a mathematical problem in which the most optimal solution is sought according to the objective function of the problem, taking into account the decision variables and constraints provided by the problem.**
2. Formally define a linear optimization problem (also called linear programming problem).  
**It's a linear programming problem which involves a linear objective function subject to a set of linear constraints, the objective function and constraints are always linear functions also the decision variables are always real numbers.**
3. Formally define an integer optimization problem (also called integer programming problem).  
**It's a type of optimization problem where the decision variables are integer values, the objective function and constraints are linear, but the additional constraint of integer values for variables introduces combinatorial aspects in the problem.**
4. What is the method typically used for solving linear programming problems (of any size)?  
**The simplex method is commonly used for solving linear programming problems of multiple sizes.**
5. What is the method typically used for solving integer programming problems?  
**Branch and bound is commonly used for solving integer programming problems.**
6. What is the main difference between a linear programming problem and an integer programming problem?  
**In the integer programming problem decision variables have integer values.**
7. When do we say that an optimization problem is "easy" to solve?  
**When there is an algorithm that can find the optimal solution efficiently in polynomial time.**

8. When do we say that an optimization problem is “hard” to solve?  
**When there is not an algorithm that can find the optimal solution or the ones who exist requires exponential time in base of the size of the input.**
9. What is a heuristic method for optimization problems?  
**It’s an approximate algorithm or strategy used to find good solutions to optimization problems, especially in cases where finding exact solution is computationally impractical or too time-consuming.**
10. What is an exact method for optimization problems?  
**It’s an algorithm that guarantees finding the optimal solution in an optimization problem, given enough computational resources. The exact methods are more computationally intensive than heuristic methods.**
11. What is a brute-force method for optimization problems?  
**A brute-force method involves exhaustively trying all possible solutions to an optimization problem, without necessarily using a specific algorithmic strategy. While effective for small instances, it becomes impractical for larger problems due to the exponential increase in possibilities.**
12. What are the main reasons heuristic methods are used?  
**Because they provide quick and often satisfactory solutions, sacrificing optimality for efficiency.**
13. What is a combinatorial optimization problem?  
**It’s an optimization problem which involves optimizing a function over a finite set of discrete solutions. These problems often involve making choices from a finite set of possibilities, and integer programming is a common framework for addressing combinatorial optimization problems.**

**Note:** You must submit a PDF file (named: **HW1-Firstname\_Lastname.pdf**) typeset electronically with your answers to both: [roger@yalma.fime.uanl.mx](mailto:roger@yalma.fime.uanl.mx) and [rz.rios@utexas.edu](mailto:rz.rios@utexas.edu) by the due date.