Advanced Automation and Control

Optimization Part

Surname............................ Name............................

Thursday 26$^{\text{th}}$ January, 2023

Exercise 1

1. Rewrite the optimization problem in **standard form**. Depict the tree associated to the MILP.

2. Write down the relaxed problem at node 0 **and** the optimization problem for Phase 1.

$\downarrow$ $\downarrow$

3. Simplex algorithm at node 0

(a) Solve Phase 1

(b) Simplex algorithm **Phase 2**

i. The optimization problem is feasible, unbounded or infeasible? Please motivate the answer.

ii. The optimal cost of the relaxed problem is:

(c) After examining nodes 0, can we provide a conclusion for the original MILP (Yes, No, Why)?

If Yes:

i. The original MILP is feasible, unbounded or infeasible? Please motivate the answer.

ii. the optimal cost for the original MILP is:

Exercise 2

1. Indicate the initial set of chosen optimization variables and their meaning. Do not include here the auxiliary variables required to resolve bilinearities or "if" conditions.

2. Please report all the steps required to obtain the MILP formulation of the problem

3. Write down the final set of optimization variables (after having resolved bilinearities etc.) and their meaning

4. Write down the final **linear** objective function

5. Write down all the constraints

Exercise 3

1. Depict the cost function (IN THE BOX) and indicate if it is convex (IN THE SMALL BOX and motivate the answer OUT OF THE BOX).

2. Depict the feasibility domain of the problem (IN THE BOX). Is the domain convex? (ANSWER YES/NO IN THE SMALL BOX and motivate the answer OUT OF THE BOX)?

3. Indicate if the optimisation problem is convex (motivate the answer).

Exercise 4