DISCRETE OPTIMIZATION **COMS4050&COMS7057**
ASSIGNMENT-II **3 October, 2025**

QUESTION 1

The Knapsack Problem (KP) is considered to be a combinatorial optimization problem. A Knapsack model serves as an abstract model with broad spectrum applications such as: Resource allocation problems, Portfolio optimization, Cargo-loading problems and Cutting stock problems. The Linear KP problem is presented below:

$$\max \sum_{i=1}^{n} v_i x_i \quad \text{such that}$$

$$\sum_{j=1}^{n} w_j x_j \leq W,$$

where $x^T = (x_1, x_2, \cdots, x_n)$, $n = 16$, x_is are the binary optimization variables. The data for the problem are given below
$(v_i, w_i) = \{(6,3), (8,5), (3,4), (4,7), (5,4), (9,10), (11,3), (12,6),$
$(6,8), (8,14), (13,4), (15,9), (16,10), (13,11), (9,17), (25,12)\}$ with total capacity W = 25.

Solve the above problem using the local search algorithm FM. Use your initial solution $x^T = (x_1, x_2, \cdots, x_{16})$ where $x_i = 0$ if the index i in x_i is even and $x_i = 1$ if the index i is odd. The step by step description of the Fiduccia and Mattheyses (FM) algorithm is given in the next page.

Total Marks: 10

SUBMIT YOUR ASSIGNMENT BY 5PM, 17th SEPTEMBER, 2025.

END