INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SONEPAT
भारतीय सूचना प्रौद्योगिकी संस्थान सोनीपत
Email: sonepatiiit@gmail.com, website: www.iiitsonepat.ac.in

Mid Sem-II	**Subject: DAA (CSL302)**	**Roll no ……**
Branch: CSE	**M.M.-15 marks**	**Time- 60 mint.**

Note: All questions are compulsory.

Q.[1] (a) Prove that the fractional knapsack problem has the greedy-choice property. **1.5**

Q.[1](b) Design an algorithm to solve the fractional knapsack problem in **O(*n*)** time. **1.5**

Q.[2](a) Write an optimal Huffman code for the following set of frequencies, based on the first 8 Fibonacci numbers? **2**

a:1 b:1 c:2 d:3 e:5 f:8 g:13 h:21

Can you generalize your answer to find the optimal code when the frequencies are the first ***n*** Fibonacci numbers?

Q.[2](b) Write the elements of the greedy strategy 1

Q.[3] Given a graph G and a minimum spanning tree T, suppose that we decrease the weight of one of the edges in T. Show that T is still a minimum spanning tree for G. More formally, let T be a minimum spanning tree for G with edge weights given by weight function w. Choose one edge $(x, y) \in T$ and a positive number k, and define the weight function w' by

$$w'(u,v) = \begin{cases} w(u,v) & \text{if } (u,v) \neq (x,y)\,, \\ w(x,y) - k & \text{if } (u,v) = (x,y)\,. \end{cases}$$

Show that T is a minimum spanning tree for G with edge weights given by w'.

Q.[4](a) Design Prim's algorithm to runs in $O(V^2)$ time for a graph G(V, E) as an adjacency matrix. **1.5**

Q.[4](b) Which algorithm, Kruskal's or Prim's, will run faster if we provide the uniformly distributed edge weights in a graph over the half-open interval [0,1). **1.5**

Q.[5](a) Give a dynamic-programming solution to the 0-1 knapsack problem that runs in $O(n.W)$ time, where n is the number of items and W is the maximum weight of items that the thief can put in his knapsack. **1.5**

Q.[5](b)

Suppose that instead of always selecting the first activity to finish, we instead select the last activity to start that is compatible with all previously selected activities. Describe how this approach is a greedy algorithm, and prove that it yields an optimal solution.