Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, May 2025

Course: Advanced Algorithms **Semester: II**

Program: 1st Year M.Tech SoCS **Time: 03 hrs.**

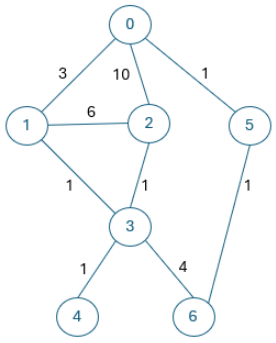
Course Code: CSEG7032 **Max. Marks: 100**

Instructions: 1) Calculator use is allowed.
2) I-Card should be verified before starting the exam.
3) Discussion and sharing copies during the examination is strictly prohibited.
4) Mobile phones, smart watch, any other electronic device is not allowed.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain with example for depth-first search and computation of strongly connected components.	**4**	**CO1**
Q 2	Provide the dynamic programming example for Fibonacci sequence in O(1) time.	**4**	**CO2**
Q 3	Explain the halting problem with example pseudo-code.	**4**	**CO2**
Q 4	Perform the following conversions: a) Hex $(10AF)_{10}$ to Binary. b) Binary $(1011010111)_2$ to Octal. c) $(345)_{10}$ to Base 9. d) $(345)_{10}$ to Base 2.	**4**	**CO1**
Q 5	Write the Edmond-Karp maximum-flow algorithm.	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q 5	Write algorithm for Floyd-warshall and find output for following graph: 	**10**	**CO3**

Q 6	Solve the LUP decomposition using following simultaneous linear equations: $x_1 + x_2 + x_3 = 1$ $3x_1 + x_2 - 3x_3 = 5$ $x_1 - 2x_2 - 5x_3 = 10$	**10**	**CO3**
Q 7	Calculate 0/1 knapsack using dynamic programming solution where weight = {3,4,6,5}, value/profit={2,3,5,4} with total weights as 5 and number of items is 4.	**10**	**CO4**
Q 8	Apply strassen's matrix multiplication to solve in 7 recursive calls. $\begin{pmatrix} 5 & 2 & 6 & 1 \\ 0 & 6 & 2 & 0 \\ 3 & 8 & 1 & 4 \\ 1 & 8 & 5 & 6 \end{pmatrix} \times \begin{pmatrix} 7 & 5 & 8 & 0 \\ 1 & 8 & 2 & 6 \\ 9 & 4 & 3 & 8 \\ 5 & 3 & 7 & 9 \end{pmatrix}$ **OR** Find the value of x for Chinese remainder theorem (CRT) for equations: $x = 2 \pmod 5$ $x = 3 \pmod 7$ $x = 10 \pmod{11}$	**10**	**CO4**
SECTION-C **(2Qx20M=40 Marks)**			
Q 9	Write the NP-completeness proof method with example of independent set to CLIQUE.	**20**	**CO5**
Q 10	Write the simplex algorithm and solve the following problem using simplex method: Let, x_1 = The number of hours per week Alice will work at Job I and x_2 = The number of hours per week Alice will work at Job II. Find the variable to be maximized as Z income with 12 job hours/week . Maximize $Z = 40x1 + 30x2$ Subject to: $x1 + x2 \leq 12$ $2x1 + x2 \leq 16$ $x1 \geq 0; x2 \geq 0$	**20**	**CO5**