Module: INT102 **Assessment 2**

1. Assessment

The tasks contribute 10% to the overall assessment of INT102.

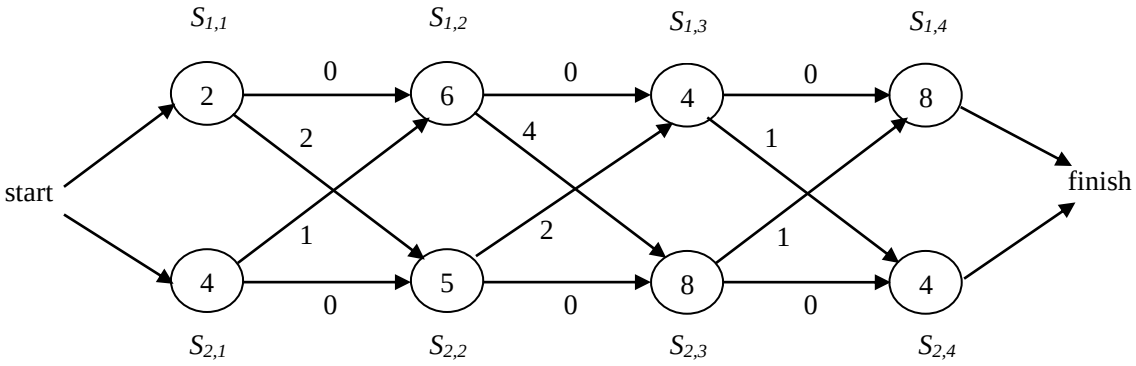
2. Submission

Please complete the assessment tasks using Microsoft Word and submit a PDF file via LM.

Deadline
17 - May - 2024, Friday, 17:30.

Question 1 (18 marks)

Suppose there are two assembly lines each with 4 stations, $S_{i,j}$. The assembly time is given in the circle representing the station and the transfer time is given next to the edge from one station to another.



1. Using dynamic programming, fill in the table of the minimum time $f_i[j]$ needed to get through station $S_{i,j}$ and the *line* of the station just before $S_{i,j}$ on the fastest way to get through $S_{i,j}$. Show all the intermediate steps in computing these values. **(8 marks)**

2. What is the minimum time f^* needed to get through the assembly line? **(2 marks)**

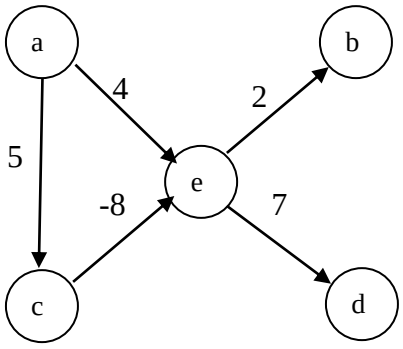
3. Based on the line information on the table, show how to find the fastest way (which stations should be chosen?) **(8 marks)**

Question 2 (14 marks)

1. Given a pattern CGTGC, create a shift table for letters A, G, C, T. **(4 marks)**
2. Apply Horspool's algorithm to search the pattern in text AGCCGTGC, what is the number of comparisons. **(10 marks)**

Question 3 (16 marks)

For the following graph, run Bellman-ford algorithm to find all shortest paths from vertex *a*.



Question 4 (30 marks)

Using a gap penalty of d=-5 and scoring matrix as below

	A	**C**	**G**	**T**
A	**2**	**-7**	**-5**	**-7**
C	**-7**	**2**	**-7**	**-5**
G	**-5**	**-7**	**2**	**-7**
T	**-7**	**-5**	**-7**	**2**

And applying dynamic programming

1. to find the optimal global alignment of AATG and AGC **(15 marks)**
2. to find the optimal local alignment of AATG and AGC **(15 marks)**

Question 5 (22 marks)

1. Define the class P in terms of computational complexity. Explain why problems in P are considered efficient. **(6 marks)**

2. Describe the class NP and provide an example of a problem that belongs to NP but not necessarily to P. Explain why solving such problems is more challenging. **(5 marks)**

3. Define NP-complete (NPC) problems. Explain the significance of an NP-complete problem in the context of computational complexity theory. **(6 marks)**

4. Discuss the concept of polynomial-time reduction in the context of NP-completeness. How is it used to establish the NP-completeness of a problem? **(5 marks)**