Module: INT102 **Assignment 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 it in PDF via Learning. Please including **your name and student ID** on the cover page and name your file as **name_student ID**.

3. Deadline

13-May-2021, Friday, 24:00. Time zone in Beijing, China (GMT+8)

Question 7 is compulsory.

Question 1

1. Given a pattern ATGAA, create a shift table for letters A, G, C, T. **5**

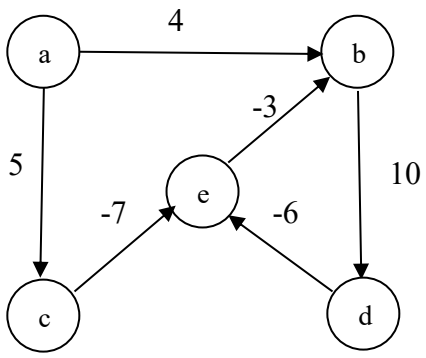
2. Apply Horspool's algorithm to search the pattern in text AGCAATGAA, what is the number of comparisons. **10**

Question 2

In the following graph, assume the edges are arranged in the order of **10**

$$e_1 = (a, b), e_2 = (a, c), e_3 = (b, d), e_4 = (c, e), e_5 = (d, e), e_6 = (e, b)$$

run Bellman-Ford algorithm to find all shortest paths from vertex *a*.



Question 3

1. Using dynamic programming, fill in the table in computing the length of the Longest Common Subsequence between sequences of GAGT and AGCCCT **10**
2. Based on the table, find one of the longest common subsequences of GAGT and AGCCCT. **5**

Question 4

Using a gap penalty of d=-1 and scoring matrix as below

	A	C	G	T
A	**1**	**-3**	**-2**	**-3**
C	**-3**	**1**	**-3**	**-2**
G	**-2**	**-3**	**1**	**-3**
T	**-3**	**-2**	**-3**	**1**

1. Optimal global alignment

    a. Using dynamic programming, fill in the table in computing the score of the optimal global alignment of GAGT and AGACCT. **10**

    b. Based on the table, find an optimal global alignment of GAGT and AGACCT. **5**

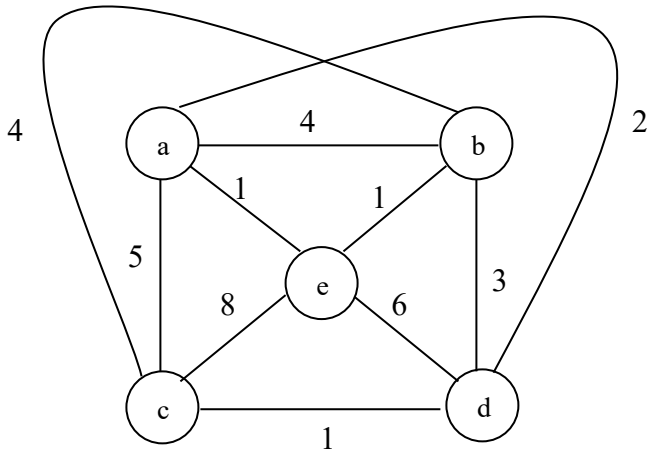
2. Optimal local alignment

    a. Using dynamic programming, fill in the table in computing the score of the optimal local alignment of GAGT and AGACCT. **10**

    b. Based on the table, find an optimal local alignment of GAGT and AGACCT. **5**

Question 5

Apply the branch-and-bound algorithm to solve the travelling salesman problem for the following complete graph. **10**



Question 6

Which of the following statements do not contradict the current state of our knowledge about the complexity classes P, NP, and NPC (NP-complete problems)? Briefly justify your answer.

1. $P = NP = NPC$ **3**
2. $P = NP$ but $NPC \subset NP$ **3**
3. $P \neq NP$, $NP = P \cup NPC$ and $P \cap NPC = \{\}$ **3**
4. $P \neq NP$, $P \cap NPC \neq \{\}$ **3**
5. $P \neq NP$, $P \cap NPC = \{\}$ **3**

Question 7 (COMPULSORY)

Do you complete the assignment independently? **5**