INT102 Algorithmic Foundations

Problem Session Week 8

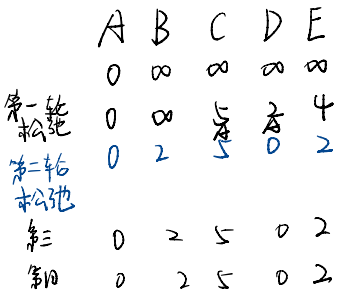
Group1: 09:00-11:00, 21/04/2023, Friday

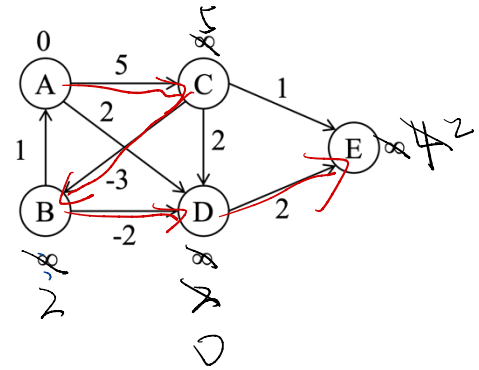
Group2: 17:00-19:00, 21/04/2023, Friday

Location: SC176/Online

Question 1

Apply Bellman-Ford algorithm to find the shortest paths from the source to all other vertices. G is as following and A is the source vertex.





Question 2

Assuming that the set of possible list is {*a, b, c, d*}, sort the following list inalphabetical order by the counting algorithm:

b, c, d, c, b, a, a, b

Question 3

Consider the problem of searching for genes in DNA sequences using Horspool's algorithm. A DNA sequence is represented by a text on the alphabet {A, C, G, T}, and the gene or a gene segment is a pattern.

3A. Construct the shift table for the following gene segment.

A	C	G	T
5	2	10	1

TCCTATTCTT

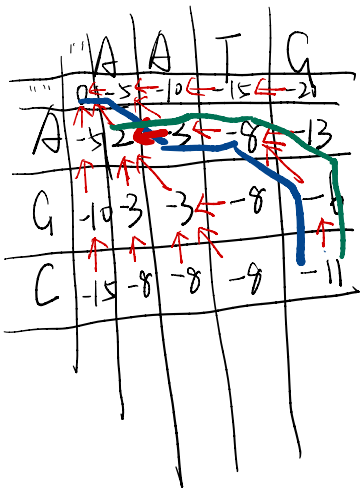
3B. Apply Horspool's algorithm to locate the pattern in the following DNA sequence.

TTATAGATCTGGTATTCTTTATAGATCTCCTATTCTT

Question 4

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
2. to find the optimal local alignment of AATG and AGC

Question 5

Suppose there are 10 people in a room. Each person shakes hands with some other people in the room. Prove that the number of people having an odd number of handshakes is even.

(Challenge: This puzzle is equivalent to the question in an undirected graph, “prove that the number of vertices with odd degree is even”. Try to think why the two questions are equivalent.)