	FINAL EXAM	Semester / Academic year	1	2021-2022
		Date		21/12/2022
	Course title	Discrete Structure for Computing		
UNIVERSSITY OF TECHNOLOGY	Course ID	CO1007		
FACULTY OF CSE	Duration	90 mins	Question sheet code	2215

Notes: - Student does not use course materials except one A4 (single side) hand-writing document.
- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.

I. Multiple choices (10.0p):

1. [L.O.2.3] Find the shortest distance from a to z on the network below.
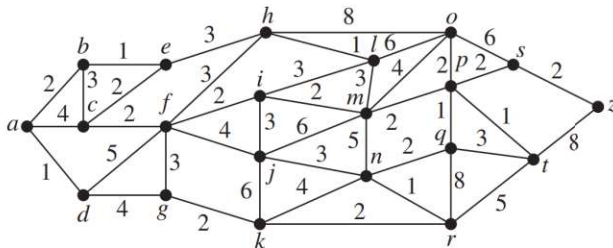

   (a)   The shortest distance is 16

   (b)   The shortest distance is 18

   (c)   The shortest distance is 20

   (d)   The shortest distance is 14

2. [L.O.1.2] The mathematics department has six committees, each meeting once a month. How many different meeting times must be used to ensure that no member is scheduled to attend two meetings at the same time if the committees are $C_1 = \{Arlinghaus, Brand, Zaslavsky\}$, $C_2 = \{Brand, Lee, Rosen\}$, $C_3 = \{Arlinghaus, Rosen, Zaslavsky\}$, $C_4 = \{Lee, Rosen, Zaslavsky\}$, $C_5 = \{Arlinghaus, Brand\}$, and $C_6 = \{Brand, Rosen, Zaslavsky\}$?

   (a)   3

   (b)   4

   (c)   5

   (d)   6

3. [L.O.4.1] Consider a wheel graph $W_n = (V; E)$, with a center v_0, and with adjacency matrix A. In your opinion, which of the following statements is correct:

   (a) W_n has an even number of edges, and every row of A consists of the same number of 1.

   (b) W_n has $(n+1)$ vertices and does not contain a spanning tree.

   (c) W_n has $(n+1)$ vertices and contains an Euler circuit.

   (d) W_n contains a spanning tree and the number of edges of W_n is even.

4. [L.O.1.2] Let G be a graph with v vertices and e edges. Let M be the maximum degree of the vertices of G, and let m be the minimum degree of the vertices of G. Which one of the following is TRUE?

   (a) $m \leq 3e/v \leq M$

   (b) $m \leq 2v/e \leq M$

   (c) $m \leq 2e/v \leq M$

   (d) $m \leq e/v \leq M$

5. [L.O.1.2] Choose as the root, what is the breath-first (start from e) search of the given the graph G: (assume that the vertices are ordered alphabetically)
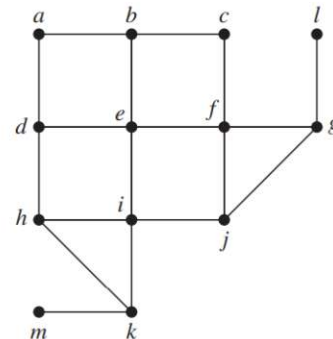
   (a)   e b d f i a c h g j k l m

   (b)   e d b f i a c h g j k l m

   (c)   e b d f i a c h g l j k m

   (d)   None of these answers is correct

6. [L.O.4.2] A certain drug is effective in treating a disease if the concentration remains above 100 mg/L. The initial concentration is 600 mg/L. It is known from laboratory experiments that the drug decays at the rate of 18% of the amount present each hour. Let an be the concentration of drug after n hours. The minimum amount of time passed when the drug concentration just becomes ineffective is

   (a) $n = 8$ hours

   (b) $n = 9$ hours

   (c) $n = 10$ hours

   (d) $n = 12$ hours

7. [L.O.1.2] Are the following graphs isomorphic?

G5   G6   G7
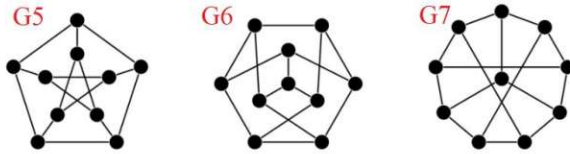
(a)   G5 and G6 are isomorphic

(b)   G6 and G7 are isomorphic

(c)   All of thess graphs are isomorphic

(d)   All of these graphs are not isomorphic

8. [L.O.4.1] Given two graphs $G3$ and $G4$:

G3   G4
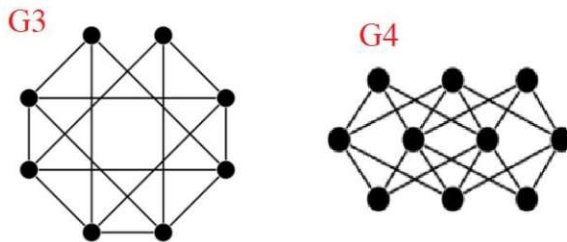
Which of the following statements is TRUE?

(a) $G3$: Exists Hamilton circuit, $G4$: Exists Hamilton circuit

(b) $G3$: Exists Hamilton circuit, $G4$: No Hamilton circuit

(c) $G3$: Exist Euler circuit, $G4$: No Hamilton circuit

(d) $G3$: No Hamilton circuit, $G4$: No Euler path

9. [L.O.1.2] Let consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices
a	b, d, f
b	a, c, e
c	b, d, h
d	a, c, g
e	b, f, h
f	a, e, g
g	d, f, h
h	c, e, g

Which of the following is correct ?

(a)   The graph is bipartite.

(b)   The graph has no Euler circuit.

(c)   The graph has a Hamilton circuit.

(d)   All of the answers are correct.

10. [L.O.4.1] Find a minimum spanning tree for the given
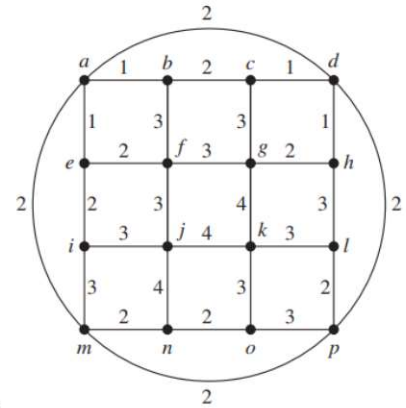
weighted graph

(a)   Total weight of 28 and $\{a, b\}, \{a, d\}, \{g, h\}$ belong to spanning tree

(b)   Total weight of 26 and $\{a, b\}, \{e, i\}, \{f, j\}$ belong to spanning tree

(c)   Total weight of 26 and $\{i, h\}, \{d, f\}, \{m, o\}$ not belong to spanning tree

(d)   Total weight of 30 and $\{i, h\}, \{d, f\}, \{m, o\}$ not belong to spanning tree

11. [L.O.4.1] A software firm in HCM City has a set A of $(m - 2)$ employees, and a set B of $(m + 2)$ jobs to be assigned to potential employees (where $m \in N$ and $m \geq 3$). Let

$$V = A \cup B, E = \{(a, b) : a \in A \text{ and } b \in B\}$$

and call $K_{m-2, m+2}$ be the complete bipartite graph defined by V and E. In practice, we must assume that every employee $x \in A$ can uniquely do one job, and each job $y \in B$ can be assigned to at most one employee. The number of all possible ways of assigning employees for jobs is:

(a) $m^2 - 4$

(b) $\frac{(m-2)!}{4!}$

(c) $\frac{(m+2)!}{3!}$

(d)   Another answer

12. [L.O.4.1] What is the correct Post-fix expression for the following expression ($\uparrow$ means power)?

$$A + B \times C / (E - F) - K + U \times (I - H) \uparrow 2$$

(a) $ABC \times EF - / + K - UIH - 2 + \uparrow \times$

(b) $ABC \times EF - / + K - UIH - 2 \uparrow \times +$

(c) $ABC \times EF - / + K - UIH - 2 \times +$

(d)   Another answer

13. [L.O.4.1] A tree $T = (V; E)$ has eight nodes of degree 1, three nodes of degree 2, two nodes of degree 3, and the other nodes all have degree 4. The number of edges of tree T is

   (a)   14

   (b)   16

   (c)   18

   (d)   20

14. [L.O.3.1] Mala has a coloring book in which each English letter is drawn two times. She wants to paint each of these 52 prints with one of k colors, such that the color-pairs used to color any two letters are different. Both prints of a letter can also be colored with the same color. What is the minimum value of k that satisfies this requirement ?

   (a)   9

   (b)   8

   (c)   7

   (d)   6

15. [L.O.4.2] The number of binary strings of n zeros and k ones such that no two ones are adjacent is:

   (a) $(n-1)Ck$

   (b) nCk

   (c) $nC(k+1)$

   (d)   None of these answers is correct.

16. [L.O.4.2] An Ear-Nose-Throat center has the proportion of Ear, Nose, Throat patients respectively 25%, 40%, 35%; the rate of severe disease requiring surgery is 1%, 2%, 3%, respectively. Randomly select a patient from this center we see that this person was surgery. What is the probability that the selected person has a nose disease?

   (a)   0.381

   (b)   0.008

   (c)   0.021

   (d)   0.312

17. [L.O.3.1] An athlete decides to climb the mountain in a specific day from A to B. If this person has an accident or bad weather, he will immediately stop climbing and return to A. According to the survey this season, the possibility of a day with good weather 60%, with normal weather 30% and bad weather 10%. Know that the chance of this athlete having an accident in good weather is 1% and this chance is 5% in normal weather. Find the probability that this athlete reaches to B.

   (a)   2.1%

   (b)   12.1%

   (c)   97.9%

   (d)   87.9%

18. [L.O.4.1] Which of the following statements is TRUE?

   (a)   If a simple undirected graph $G1$ has exactly 6 vertices with the degrees are $3, 4, 4, 5, 6, 6$. Then $G1$ is not planar.

   (b) $\overline{C_n}$ is not planar when $n \geq 7$. Where $\overline{C_n} \cup C_n \equiv K_n$

   (c)   If a planar graph $G1$ has less than 12 vertices then $G1$ must have a vertex of degree at most 5.

   (d)   More than one answers above are correct.

19. [L.O.3.1] Apply Floyd-Warshall algorithm and determine the stopping matrix for the following graph
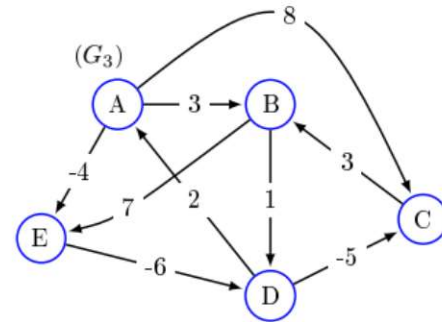
   (a) $L^{(3)}$

   (b) $L^{(4)}$

   (c) $L^{(5)}$

   (d) $L^{(2)}$

Questions from 20–21, consider the following graph G_8 in order to find the shortest paths from vertex A to the others by **Bellman-Ford** algorithm.
Suppose that columns in the tracing table are ordered (from left to right) in alphabetical order (i.e., $A \to B \to \ldots$). Suppose that the initialization row corresponds to step 0.
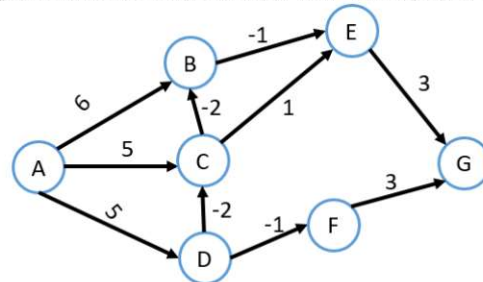
20. Which of the following is the shortest path from A to G?

   (a) $A \to C \to B \to E \to G$; total weight $= 5$

   (b)   Exists a shortest path from A to G with the total weight is 3

   (c)   None of the above answers is correct

   (d)   There exists a circle of negative length

21. Running the algorithm, which is obtained for row 4 (step 4) ?

    (a) 0; 1; 3; 5; 2; 4; 7
    (b) 0; 1; 3; 5; 0; 4; 3
    (c) 0; 1; 3; 5; 0; 4; 5
    (d) 0; 3; 3; 5; 5; 4; ∞

22. [L.O.4.1] Suppose that G is a directed graph and T is a spanning tree constructed using breadth-first search. Which of the following statements is true?

    (a) Every edge of G has endpoints that are at the same level or one level higher or lower
    (b) Suppose that $T1, T2$, and $T3$ are spanning trees of the simple graph G. Then the distance between $T1$ and $T3$ exceed the sum of the distance between $T1$ and $T2$ and the distance between $T2$ and $T3$.
    (c) Two above answers are not correct.
    (d) Two above answers are correct.

23. [L.O.1.2] Find in-order traversal of a binary tree with pre-order $ADEBJCFHIG$ and post-order $EJBDHIFGCA$

    (a) $EDJBAHFICG$
    (b) $EDJBAFHICG$
    (c) $EDJBAHFCIG$
    (d) $ADJBEHFICG$

24. [L.O.4.2] Let X be the number of 'bad' floods that could randomly happen in Hochiminh City each year. Assume that X is described by the binomial random variable $X \sim Bin(n, p)$ with $n = 6$, $p = 0,5$. The probability $P[X > 2|X \le 3]$ is

    (a) 0.433
    (b) 0.476
    (c) 0.533
    (d) 0.676

25. [L.O.3.1] An airline sells 62 tickets for a plane with a capacity of 60 passengers. This is done because it is possible for some people to not show up. The probability of a person not showing up for the flight is 0.1. All passengers behave independently. Find the probability of the event that the airline does not have to arrange separate tickets for excess people.

    (a) 0.788
    (b) 0.888
    (c) 0.988
    (d) 0.688