Lecturer:	(Date)	Approved by: (Date)	
(Signature and Ful	lname)	$(Signature\ and\ Fullname)$	

BK THEM	FINAL EXAM		Semester / Academic year Date	2 2022-2023 30/05/2023		
	Course title	Discrete Structure for Computing				
UNIVERSITY OF TECHNOLOGY	Course ID	CO1007				
FACULTY OF CSE	Duration	80 mins Question sheet code 222				
Notes: - Students do not use course materials except one A4 hand-writing document						

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.

For questions 1–5, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

1. (L.O.2.2) Assume that the index of the cell (or the graph's edge) in the adjacency matrix will be indexed by order of alphabet and number (from 1 to the end). For instance, cell (A, B) is indexed (1, 2), cell (A, A) is (1,1), cell (A,C) is (1,3), ..., (G,G) is (7,7).

Start from A; the initialize step is Step 0; find the value of the Bellman-Ford algorithm's Third step (Step 3). Note that the weight of an edge is not fixed; instead, it will be changed following the rule:

The weight of the cell/edge where the sum of the row and column index is an odd number will be reduced by 1 after every 2 step of calculation (if the weight is 1, it cannot reduce more). For instance, at the first and second steps, the value of cell (1,2) a.k.a edge (A,B) is 8, and when calculating at the third and fourth steps, it will be 7 and will be further decreased to 6 when calculating fifth and sixth, ...

- A. 0,4,3,1,4,1,2
- B. 0,5,3,1,4,2,3
- C. 0,8,3,1,5,2,3
- D. 0,3,2,1,3,1,2

2. (L.O.2.2) Can we remove an edge from H to create H_1 so that H_1 has an Euler circuit? If yes, what edge can we remove?

A. Can, remove edge BG

- B. Can, remove edge AF
- C. All the other choices are incorrect
- D. Cannot

3. (L.O.2.2) Apply BFS from B to find a spanning tree of H. What is the total weight of this spanning tree? Note: When choosing between multiple vertices, choose according to the alphabet in ascending order.

A. 22

B. 9

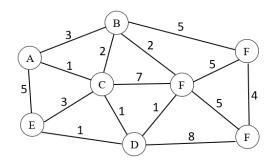
C. 12

D. 16

4.	(L.O.2.2) Find the minimum	spanning tree of H with the	he root D , we follow the c	riteria:				
	• If a child is earlier than	its parent in the alphabet	, it is a left child, else it is	a right child				
	• There can be more than	1 left child or more than	1 right child.					
	• When choosing between the alphabet list.	multiple edges, select the	edge with the earliest alpl	nabet in ascending order of				
	What is the in-order traverse A. A C F D B E G	of the obtained tree? B. C F A D B G E	C. C F A B G E D	D. F C A D G B E				
5.	(L.O.2.2) Given a set X consprobability of choosing a graph the vertices is the same		_	_				
	A. 0.4222	B. 0.0063	C. 0.0066	D. 0.4444				
6.	(L.O.2.2) A building has a g elevator at G . How many way							
	(a) every floor has at least	one person get out and,						
	(b) the order of the people	coming out on the same fl	oors does not matter					
	A. 8400.	B. 4800.	C. 1319.	D. 1913.				
7.	(L.O.3.1) An athlete decides accident or bad weather, h season, the possibility of a da Know that the chance of this normal weather. Find the pro-A. 2.1%.	e will immediately stop clay with good weather is 60 s athlete having an accide	imbing and return to A . A 9% , normal weather is 30% ent in good weather is 1%	ccording to the survey this 5, and bad weather is 10%.				
8.	(L.O.2.2) Consider a team che play games against every play winning team, and the probability match, and what is the probability A . All the others answer C . $W_{5.5}$, 0.422	ver from the opponent tear bility of winning for each p bility of there being a win	m. The team that has morplayer is the same. What k	re wins in the match is the				
9.	(L.O.3.1) Let $G = (V, E)$ be a weights $w(i, j)$ are assigned as			edges of the graph and its				
		$E = \{(i, j) j = i + 1, \text{ or } \}$	j = 3i, $w(i, j) = 1$,					
	for all $(i, j) \in E$. The shortest A. 4.	path in G from vertex u B. 7.	= 1 to vertex $v = 100$ has C. 27.	length D. 33.				
10.	(L.O.2.2) The number of relations $A. 2^{2023^2}$.							
11.	1. (L.O.2.2) Given a W_3 graph, the cycle vertices are indexed from 1 to 3, and the middle vertex is 4. The value of each edge is the sum of its adjacency vertex. For instance, the edge between vertex 2 and 3 has a value of 5. What is the expectation of the total value of a spanning tree chosen from this W_3 ?							
	A. 15	B. 14.25	C. 15.5	D. 16				

 Stu.ID:
 Page: 2

12. (L.O.3.2) Consider the weighted undirected graph G



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

B. 15

C. 12

D. 30

13. (L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s?

A. 248.

B. 250.

C. 249.

14. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?

(I) 7,6,5,5,5,4,4,2,2;

A. I and IV.

- (II)7,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV)9,9,6,6,6,6,5,4,3,2B. II and III.
 - C. I only.
- D. II and IV.

15. (L.O.2.2) What is the probability that

$$x + y + z \equiv 1 \mod p$$
,

when x, y and z are chosen uniformly at random from $\{0, \ldots, p-1\}$ with an odd prime number p?

- A. $1/p^3$.
- B. 1/p.

C. 3/p.

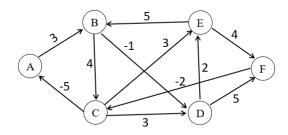
16. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?

A. 12

C. 12.5

D. 11

17. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

A. 3, 5, 2, 4, and 7.

B. 3, 7, 4, 5, and 7.

C. 3, 7, 2, 4, and 7.

D. The shortest paths do not exist.

18. (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

19. (L.O.1.2) How many arrangements of the letters in ABRACADABRA have no A adjacent to a B?

A. 5660

B. 3360

C. 5520

D. 5880

20. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices
\overline{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 assessments is correct?

A. The graph is bipartite.

- B. The graph has no Euler circuit.
- C. The graph has a Hamilton circuit.
- D. All answers are correct.

21. (L.O.1.2) How many ways are there to select five bills from a cash box containing \$1, \$2, \$5, \$10, \$20, \$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each denomination are indistinguishable, and there are at least five bills of each type.

A. 462

D. 1287

22. (L.O.3.1) Assume the population's disease B ratio is 1/10000. What is the probability of a person having B, given that person tests positive for B? Assume that there is a 99.9% chance a person with the disease tests positive, and a 0.02% chance a person without B tests positive for it. Choose the best approximate of the probability.

- A. 33.31%
- B. 18.02%
- C. 75.53%
- D. 52.25%

23. (L.O.3.1) A grocery store has a promotion for customers when shopping. The promotional gift is any 10 toothbrushes from Colgate, Oral-B, and P/S brands. How many different ways to create promotional gifts?

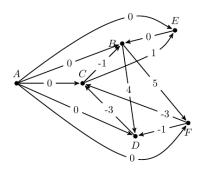
A. 23

B. 12

C. 87

D. 66

24. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

- A. -4, -5, 1, -1, 0. B. -4, -4, -1, -2, 0. C. -5, -4, -1, -3, 0. D. Another answer.

25. (L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves?

A. 33

B. 28

C. 25

D. 30

1. A. 8. **A**. 15. B. 22. A. 9. B. 2. **A**. 16. A. 3. A. 10. D. 17. A. 23. D. 4. A. 11. A. 18. A. 5. A. 12. B. 19. D. 24. C. 13. A. 6. **A**. 20. D.

7. D. 21. A. 25. C.

Lecturer:	(Date)	Approved by: (Date)
(Signature and Fullname)		(Signature and Fullname)

BK TO JOSEM	FINAL FXAM		Semester / Academic year Date	2 2022-2023 30/05/2023			
	Course title	Discrete Structure for Computing					
UNIVERSITY OF TECHNOLOGY	Course ID	CO1007					
FACULTY OF CSE	Duration	80 mins	Question sheet code	2222			
Notes: - Students do not use course materials except one A4 hand-writing document							

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.
- 1. (L.O.2.2) Consider a team chess match, knowing that each team has 5 players, and each player will have to play games against every player from the opponent team. The team that has more wins in the match is the winning team, and the probability of winning for each player is the same. What kind of graph represents the match, and what is the probability of there being a winning team?

A. $K_{5.5}$, 0.5

B. All the others answers are incorrect

C. $K_{5.5}$, 0.589

D. $W_{5.5}$, 0.422

2. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices
\overline{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 assessments is correct?

- A. All answers are correct.
- C. The graph has no Euler circuit.
- B. The graph is bipartite.
- D. The graph has a Hamilton circuit.

3. (L.O.2.2) What is the probability that

$$x + y + z \equiv 1 \mod p$$
,

when x, y and z are chosen uniformly at random from $\{0, \ldots, p-1\}$ with an odd prime number p?

- **A**. 1/3p.
- B. $1/p^3$.
- C. 1/p.

D. 3/p.

4. (L.O.3.1) A grocery store has a promotion for customers when shopping. The promotional gift is any 10 toothbrushes from Colgate, Oral-B, and P/S brands. How many different ways to create promotional gifts?

A. 66

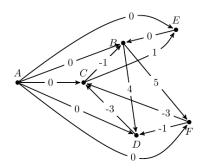
B. 23

C. 12

- D. 87
- 5. (L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G. How many ways can they get out of the elevator on the remaining floors if
 - (a) every floor has at least one person get out and,
 - (b) the order of the people coming out on the same floors does not matter
 - A. 1913.
- B. 8400.
- C. 4800.
- D. 1319.

- 6. (L.O.3.1) An athlete decides to climb the mountain on 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 is 60%, normal weather is 30%, and bad weather is 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 B.
 - A. 87.9%.
- B. 2.1%.
- D. 97.9%.

7. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

- A. Another answer.
- B. -4, -5, 1, -1, 0.
- C. -4, -4, -1, -2, 0. D. -5, -4, -1, -3, 0.
- 8. (L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves?
 - A. 30

B. 33

C. 28

- D. 25
- 9. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?
 - (I) 7,6,5,5,5,4,4,2,2;

A. II and IV.

- (II)7,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV)9,9,6,6,6,6,5,4,3,2
 - C. II and III.
- D. I only.
- 10. (L.O.1.2) How many arrangements of the letters in ABRACADABRA have no A adjacent to a B?

B. 5660

B. I and IV.

- C. 3360
- D. 5520
- 11. (L.O.1.2) Find in-order traversal of a binary tree with pre-order ADEBJCFHIG and post-order EJBDHIFGCA
 - A. ADJBEHFICG
- B. EDJBAHFICG
- C. EDJBAFHICG
- D. EDJBAHFCIG

For questions 12–16, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

Stu.ID: Stu.Fullname: Page: 2

- 12. (L.O.2.2) Assume that the index of the cell (or the graph's edge) in the adjacency matrix will be indexed by order of alphabet and number (from 1 to the end). For instance, cell (A, B) is indexed (1, 2), cell (A, A) is (1,1), cell (A,C) is (1,3), ..., (G,G) is (7,7).
 - Start from A; the initialize step is Step 0; find the value of the Bellman-Ford algorithm's Third step (Step 3). Note that the weight of an edge is not fixed; instead, it will be changed following the rule:

The weight of the cell/edge where the sum of the row and column index is an odd number will be reduced by 1 after every 2 step of calculation (if the weight is 1, it cannot reduce more). For instance, at the first and second steps, the value of cell (1,2) a.k.a edge (A,B) is 8, and when calculating at the third and fourth steps, it will be 7 and will be further decreased to 6 when calculating fifth and sixth, ...

- A. 0,3,2,1,3,1,2
- B. 0,4,3,1,4,1,2
- C. 0,5,3,1,4,2,3
- D. 0,8,3,1,5,2,3
- 13. (L.O.2.2) Can we remove an edge from H to create H_1 so that H_1 has an Euler circuit? If yes, what edge can we remove?
 - A. Cannot

B. Can, remove edge BG

C. Can, remove edge AF

- D. All the other choices are incorrect
- 14. (L.O.2.2) Apply BFS from B to find a spanning tree of H. What is the total weight of this spanning tree? Note: When choosing between multiple vertices, choose according to the alphabet in ascending order.
 - A. 16

B. 22

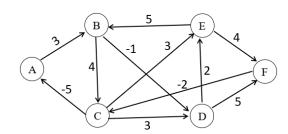
C. 9

- 15. (L.O.2.2) Find the minimum spanning tree of H with the root D, we follow the criteria:
 - If a child is earlier than its parent in the alphabet, it is a left child, else it is a right child
 - There can be more than 1 left child or more than 1 right child.
 - When choosing between multiple edges, select the edge with the earliest alphabet in ascending order of the alphabet list.

What is the in-order traverse of the obtained tree?

- A. FCADGBE
- B. ACFDBEG
- \mathbf{C} . $\mathbf{C} \mathbf{F} \mathbf{A} \mathbf{D} \mathbf{B} \mathbf{G} \mathbf{E}$
- D. CFABGED
- 16. (L.O.2.2) Given a set X consisting of sub-graphs S with 6 edges and a vertex A of degree 4. What is the probability of choosing a graph from X and that is a spanning tree? know that the probability of choosing the vertices is the same
 - A. 0.4444
- B. 0.4222
- C. 0.0063
- D. 0.0066

17. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

- A. The shortest paths do not exist.
- B. 3, 5, 2, 4, and 7.

C. 3, 7, 4, 5, and 7.

- D. 3, 7, 2, 4, and 7.
- 18. (L.O.1.2) How many ways are there to select five bills from a cash box containing \$1, \$2, \$5, \$10, \$20, \$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each denomination are indistinguishable, and there are at least five bills of each type.

B. 462

C. 792

- D. 330
- 19. (L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s?
 - A. 246.

B. 248.

C. 250.

D. 249.

20.	(L.O.3.1) Assume the population's disease B ratio is 1/10000. What is the probability of a person having B
	given that person tests positive for B? Assume that there is a 99.9% chance a person with the disease tests
	positive, and a 0.02% chance a person without B tests positive for it. Choose the best approximate of the
	probability.

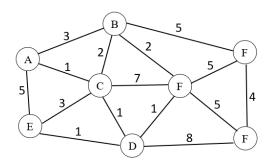
A. 52.25%

B. 33.31%

C. 18.02%

D. 75.53%

21. (L.O.3.2) Consider the weighted undirected graph G



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

A. 30

B. 18

C. 15

D. 12

22. (L.O.2.2) The number of relations that are both reflexive and symmetric on a set of 2023 elements is

A. $2^{\frac{2022*2023}{2}}$.

B. 2^{2023^2}

C. $2^{2022*2023}$.

D. $2^{\frac{2022*2023}{2}+1}$

23. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?

A. 11

B. 12

C. 13

D. 12.5

24. (L.O.3.1) Let G = (V, E) be a weighted directed graph with $V = \{1, ..., 100\}$. The edges of the graph and its weights w(i, j) are assigned according to the following rule:

$$E = \{(i, j) | j = i + 1, \text{ or } j = 3i\}, \ w(i, j) = 1,$$

for all $(i, j) \in E$. The shortest path in G from vertex u = 1 to vertex v = 100 has length

A. 33.

B. 4.

C = 7

D. 27

25. (L.O.2.2) Given a W_3 graph, the cycle vertices are indexed from 1 to 3, and the middle vertex is 4. The value of each edge is the sum of its adjacency vertex. For instance, the edge between vertex 2 and 3 has a value of 5. What is the expectation of the total value of a spanning tree chosen from this W_3 ?

A. 16

B. 15

C. 14.25

D. 15.5

20. B.

25. B.

8. D. 1. B. 14. B. 21. C. 2. A. 15. B. 9. C. 22. A. 16. B. 3. C. 10. A. 4. A. 23. B. 17. B. 11. B. 5. B. 18. B. 24. C. 12. B. 6. **A**. 19. B.

13. B.

7. D.

Lecturer:	(Date)	Approved by: (Date)
(Signature and Fullname)		(Signature and Fullname)

BK TR-ROM	FINALE	درا
	Course title	[]
UNIVERSITY OF TECHNOLOGY	Course ID	(
FACULTY OF CSE	Duration	

FINAL EXAM		Semester / Academic year		2022 2020
		Date	30/05/2023	
Course title	Discrete Structure for Computing			
Course ID	CO1007			
Duration	80 mins	Question sheet code		2223

Notes: - Students do not use course materials except one A4 hand-writing document.

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.
- 1. (L.O.3.1) A grocery store has a promotion for customers when shopping. The promotional gift is any 10 toothbrushes from Colgate, Oral-B, and P/S brands. How many different ways to create promotional gifts?

A. 23

D. 87

2. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices
\overline{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 assessments is correct?

- A. The graph is bipartite.
- C. The graph has no Euler circuit.
- B. All answers are correct.
- D. The graph has a Hamilton circuit.

3. (L.O.2.2) What is the probability that

$$x + y + z \equiv 1 \mod p$$
,

when x, y and z are chosen uniformly at random from $\{0, \ldots, p-1\}$ with an odd prime number p?

A. $1/p^3$.

B. 1/3p.

D. 3/p.

- 4. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?
 - (I) 7,6,5,5,5,4,4,2,2;

A. I and IV.

- (II)7,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV)9,9,6,6,6,6,5,4,3,2B. II and IV.
 - C. II and III.
- D. I only.
- 5. (L.O.3.1) Let G = (V, E) be a weighted directed graph with $V = \{1, ..., 100\}$. The edges of the graph and its weights w(i,j) are assigned according to the following rule:

$$E = \{(i, j)|j = i + 1, \text{ or } j = 3i\}, \ w(i, j) = 1,$$

for all $(i, j) \in E$. The shortest path in G from vertex u = 1 to vertex v = 100 has length

A. 4.

B. 33.

C. 7.

D. 27.

6. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?

A. 12

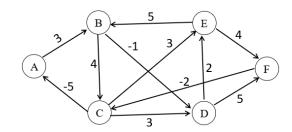
C. 13

D. 12.5

Stu.ID: ______ Stu.Fullname: _____ Page: 1

7.	(L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G . How many ways can they get out of the elevator on the remaining floors if
	(a) every floor has at least one person get out and,
	(b) the order of the people coming out on the same floors does not matter
	A. 8400. B. 1913. C. 4800. D. 1319.
8.	(L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves? A. 33 B. 30 C. 28 D. 25
9.	(L.O.2.2) Consider a team chess match, knowing that each team has 5 players, and each player will have to play games against every player from the opponent team. The team that has more wins in the match is the winning team, and the probability of winning for each player is the same. What kind of graph represents the match, and what is the probability of there being a winning team? A. All the others answers are incorrect B. $K_{5,5}$, 0.5 C. $K_{5,5}$, 0.589 D. $W_{5.5}$, 0.422
10.	(L.O.3.1) An athlete decides to climb the mountain on 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 is 60%, normal weather is 30%, and bad weather is 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 B. A. 2.1%. B. 87.9%. C. 12.1%. D. 97.9%.
11.	(L.O.1.2) How many arrangements of the letters in <i>ABRACADABRA</i> have no A adjacent to a B? A. 5660 B. 5880 C. 3360 D. 5520
12.	(L.O.2.2) Given a W_3 graph, the cycle vertices are indexed from 1 to 3, and the middle vertex is 4. The value of each edge is the sum of its adjacency vertex. For instance, the edge between vertex 2 and 3 has a value of 5. What is the expectation of the total value of a spanning tree chosen from this W_3 ? A. 15 B. 16 C. 14.25 D. 15.5
13.	(L.O.3.2) Consider the weighted undirected graph G
	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
	What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm? A. 18 B. 30 C. 15 D. 12
14.	(L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s? A. 248. B. 246. C. 250. D. 249.
15.	(L.O.2.2) The number of relations that are both reflexive and symmetric on a set of 2023 elements is A. 2^{2023^2} . B. $2^{\frac{2022*2023}{2}}$. C. $2^{2022*2023}$. D. $2^{\frac{2022*2023}{2}+1}$.
16.	(L.O.1.2) Find in-order traversal of a binary tree with pre-order $ADEBJCFHIG$ and post-order $EJBDHIFGCA$
	A. EDJBAHFICG B. ADJBEHFICG C. EDJBAFHICG D. EDJBAHFCIG

17. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

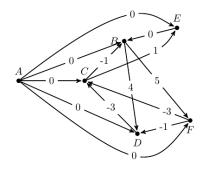
A. 3, 5, 2, 4, and 7.

B. The shortest paths do not exist.

C. 3, 7, 4, 5, and 7.

D. 3, 7, 2, 4, and 7.

18. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

- A. -4, -5, 1, -1, 0.
- B. Another answer.
- C. -4, -4, -1, -2, 0. D. -5, -4, -1, -3, 0.
- 19. (L.O.3.1) Assume the population's disease B ratio is 1/10000. What is the probability of a person having B, given that person tests positive for B? Assume that there is a 99.9% chance a person with the disease tests positive, and a 0.02% chance a person without B tests positive for it. Choose the best approximate of the probability.
 - A. 33.31%
- B. 52.25%
- C. 18.02%
- D. 75.53%
- 20. (L.O.1.2) How many ways are there to select five bills from a cash box containing \$1, \$2, \$5, \$10, \$20, \$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each denomination are indistinguishable, and there are at least five bills of each type.
 - A. 462

B. 1287

C. 792

D. 330

For questions 21-25, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

21. (L.O.2.2) Assume that the index of the cell (or the graph's edge) in the adjacency matrix will be indexed by order of alphabet and number (from 1 to the end). For instance, cell (A, B) is indexed (1, 2), cell (A, A) is (1, 1), cell (A, C) is (1, 3), ..., (G, G) is (7, 7).

Start from A; the initialize step is Step 0; find the value of the Bellman-Ford algorithm's Third step (Step 3). Note that the weight of an edge is not fixed; instead, it will be changed following the rule:

The weight of the cell/edge where the sum of the row and column index is an odd number will be reduced by 1 after every 2 step of calculation (if the weight is 1, it cannot reduce more). For instance, at the first and second steps, the value of cell (1,2) a.k.a edge (A,B) is 8, and when calculating at the third and fourth steps, it will be 7 and will be further decreased to 6 when calculating fifth and sixth, ...

A. 0,4,3,1,4,1,2

B. 0,3,2,1,3,1,2

C. 0,5,3,1,4,2,3

D. 0,8,3,1,5,2,3

22. (L.O.2.2) Can we remove an edge from H to create H_1 so that H_1 has an Euler circuit? If yes, what edge can we remove?

A. Can, remove edge BG

B. Cannot

C. Can, remove edge AF

D. All the other choices are incorrect

23. (L.O.2.2) Apply BFS from B to find a spanning tree of H. What is the total weight of this spanning tree? Note: When choosing between multiple vertices, choose according to the alphabet in ascending order.

A. 22

B. 16

C. 9

D. 12

24. (L.O.2.2) Find the minimum spanning tree of H with the root D, we follow the criteria:

• If a child is earlier than its parent in the alphabet, it is a left child, else it is a right child

• There can be more than 1 left child or more than 1 right child.

• When choosing between multiple edges, select the edge with the earliest alphabet in ascending order of the alphabet list.

What is the in-order traverse of the obtained tree?

A. ACFDBEG

B. FCADGBE

C. CFADBGE

D. CFABGED

25. (L.O.2.2) Given a set X consisting of sub-graphs S with 6 edges and a vertex A of degree 4. What is the probability of choosing a graph from X and that is a spanning tree? know that the probability of choosing the vertices is the same

A. 0.4222

B. 0.4444

C. 0.0063

D. 0.0066

8. D. 1. B. 15. B. 21. A. 2. B. 9. **A**. 16. A. 22. A. 10. B. 3. C. 17. A. 4. C. 23. A. 11. B. 18. D. 5. C. 12. A. 19. A. 24. A. 6. **A**. 13. C.

7. A. 20. A. 25. A.

Lecturer:	(Date)	Approved by: (Date)	
(Signature and Fullname	e)	$(Signature\ and\ Fullname)$	

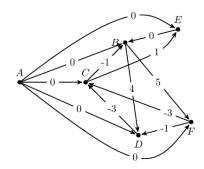
UNIVERSITY OF TECHNOLOGY	FINAL EXAM		Semester / Academic year Date	2 2022-2023 30/05/2023	
	Course title	Discrete Structure for Computing			
	Course ID	CO1007			
FACULTY OF CSE	Duration	80 mins	Question sheet code	2224	
Notes: - Students do not use course materials except one A4 hand-writing document.					

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.
- 1. (L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G. How many ways can they get out of the elevator on the remaining floors if
 - (a) every floor has at least one person get out and,
 - (b) the order of the people coming out on the same floors does not matter
 - A. 8400.
- B. 1319.
- C. 4800.
- D. 1913.
- 2. (L.O.2.2) Given a W_3 graph, the cycle vertices are indexed from 1 to 3, and the middle vertex is 4. The value of each edge is the sum of its adjacency vertex. For instance, the edge between vertex 2 and 3 has a value of 5. What is the expectation of the total value of a spanning tree chosen from this W_3 ?
 - A. 15

B. 15.5

- C. 14.25
- D. 16

3. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

- A. -4, -5, 1, -1, 0. B. -5, -4, -1, -3, 0. C. -4, -4, -1, -2, 0.
- D. Another answer.
- 4. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?
 - (I) 7,6,5,5,5,4,4,2,2;

A. I and IV.

- (II)7,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV)9,9,6,6,6,6,5,4,3,2
 - C. II and III.
- D. II and IV.
- 5. (L.O.1.2) How many ways are there to select **five bills** from a cash box containing \$1, \$2, \$5, \$10, \$20, \$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each denomination are indistinguishable, and there are at least five bills of each type.
 - A. 462

B. 330

B. I only.

C. 792

D. 1287

6. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices
\overline{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 assessments is correct?

A. The graph is bipartite.

- B. The graph has a Hamilton circuit.
- C. The graph has no Euler circuit.
- D. All answers are correct.
- 7. (L.O.1.2) Find in-order traversal of a binary tree with pre-order ADEBJCFHIG and post-order EJBDHIFGCA
 - A. EDJBAHFICG
- B. EDJBAHFCIG
- C. EDJBAFHICG
- D. ADJBEHFICG
- 8. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?
 - **A**. 12

B. 12.5

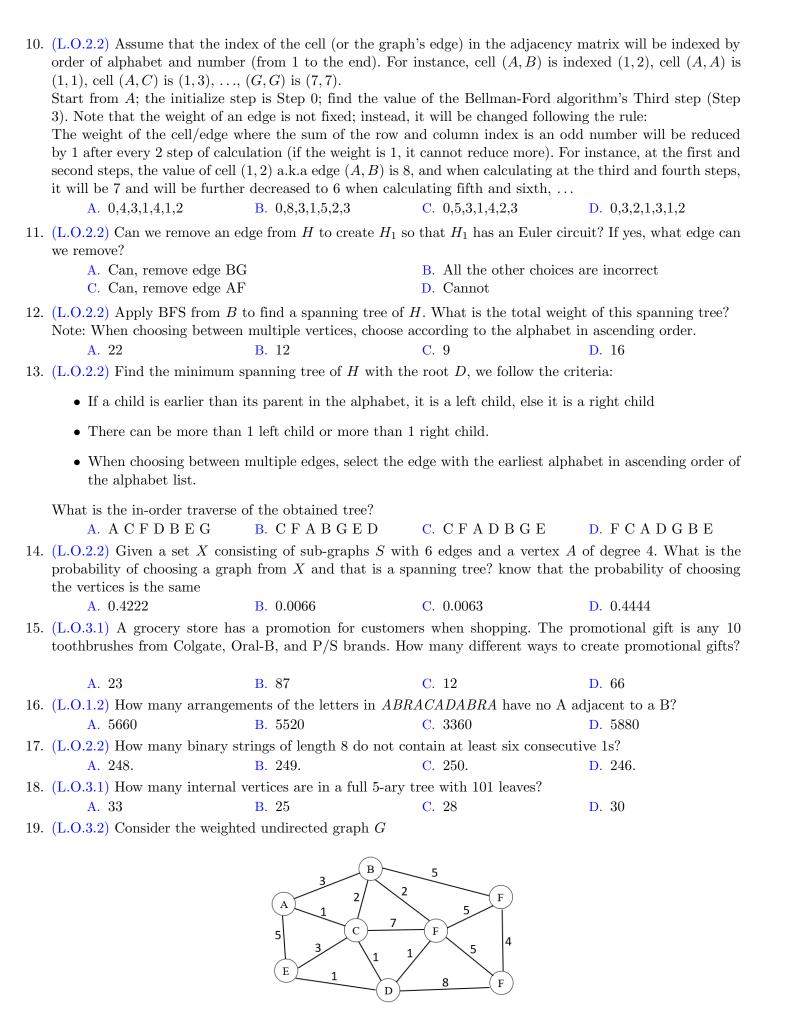
C. 13

- D. 11
- 9. (L.O.3.1) An athlete decides to climb the mountain on 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 is 60%, normal weather is 30%, and bad weather is 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 B.
 - A. 2.1%.
- B. 97.9%.
- C. 12.1%.
- D. 87.9%.

For questions 10–14, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

Stu.ID: Stu.Fullname: Page: 2



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

A. 18

B. 12

C. 15

D. 30

20.~(L.O.2.2) The number of relations that are both reflexive and symmetric on a set of 2023 elements is

A. 2^{2023^2} .

B. $2^{\frac{2022*2023}{2}+1}$.

C. $2^{2022*2023}$.

D. $2^{\frac{2022*2023}{2}}$

21. (L.O.3.1) Assume the population's disease B ratio is 1/10000. What is the probability of a person having B, given that person tests positive for B? Assume that there is a 99.9% chance a person with the disease tests positive, and a 0.02% chance a person without B tests positive for it. Choose the best approximate of the probability.

A. 33.31%

B. 75.53%

C. 18.02%

D. 52.25%

22. (L.O.3.1) Let G = (V, E) be a weighted directed graph with $V = \{1, ..., 100\}$. The edges of the graph and its weights w(i, j) are assigned according to the following rule:

$$E = \{(i, j) | j = i + 1, \text{ or } j = 3i\}, \ w(i, j) = 1,$$

for all $(i, j) \in E$. The shortest path in G from vertex u = 1 to vertex v = 100 has length

A. 4.

B. 27.

C. 7.

D. 33.

23. (L.O.2.2) What is the probability that

$$x + y + z \equiv 1 \mod p$$
,

when x, y and z are chosen uniformly at random from $\{0, \ldots, p-1\}$ with an odd prime number p?

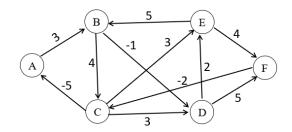
A. $1/p^3$.

B. 3/p.

C. 1/p.

D. 1/3p.

24. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

A. 3, 5, 2, 4, and 7.

B. 3, 7, 2, 4, and 7.

C. 3, 7, 4, 5, and 7.

D. The shortest paths do not exist.

25. (L.O.2.2) Consider a team chess match, knowing that each team has 5 players, and each player will have to play games against every player from the opponent team. The team that has more wins in the match is the winning team, and the probability of winning for each player is the same. What kind of graph represents the match, and what is the probability of there being a winning team?

A. All the others answers are incorrect

B. $W_{5.5}$, 0.422

C. $K_{5.5}$, 0.589

D. $K_{5,5}$, 0.5

20. D.

25. A.

1. A. 8. **A**. 14. A. 21. A. 2. A. 15. D. 9. D. 22. C. 3. B. 16. D. 10. A. 4. C. 17. A. 23. C. 11. A. 5. A. 18. B. 24. A. 12. **A**. 6. D. 19. **C**.

13. A.

7. A.

Lecturer:	(Date)	Approved by: (Date)	
(Signature and Fullr	name)	$(Signature\ and\ Fullname)$	

•	FINAL EXAM		Semester / Academic year	2 2022-2023	
UNIVERSITY OF TECHNOLOGY FACULTY OF CSE			Date	30/05/2023	
	Course title	Discrete Structure for Computing			
	Course ID	CO1007			
	Duration	80 mins	Question sheet code	2225	
Notes: - Students do not use course materi	als except one	A4 hand-wri	ting document.		

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.
- 1. (L.O.1.2) How many arrangements of the letters in ABRACADABRA have no A adjacent to a B?
- B. 5660

C. 5520

- D. 3360
- 2. (L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves?
 - A. 30

- D. 28
- 3. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices
\overline{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 assessments is correct?

A. All answers are correct.

- B. The graph is bipartite.
- C. The graph has a Hamilton circuit.
- D. The graph has no Euler circuit.
- 4. (L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s?

B. 248.

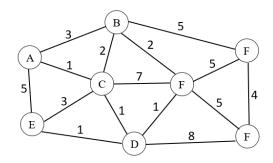
- 5. (L.O.3.1) A grocery store has a promotion for customers when shopping. The promotional gift is any 10 toothbrushes from Colgate, Oral-B, and P/S brands. How many different ways to create promotional gifts?
 - A. 66

B. 23

C. 87

D. 12

6. (L.O.3.2) Consider the weighted undirected graph G



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

A. 30

B. 18

C. 12

D. 15

Stu.ID: Stu.Fullname: Page: 1

7.	(L.O.1.2) How many ways are there to select five bills from a cash box containing \$1, \$2, \$5, \$10, \$20
	\$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each
	denomination are indistinguishable, and there are at least five bills of each type.

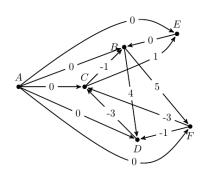
A. 1287

B. 462

C. 330

D. 792

8. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

A. Another answer.

B. -4, -5, 1, -1, 0. C. -5, -4, -1, -3, 0. D. -4, -4, -1, -2, 0.

9. (L.O.2.2) What is the probability that

$$x + y + z \equiv 1 \mod p$$

when x, y and z are chosen uniformly at random from $\{0, \ldots, p-1\}$ with an odd prime number p?

A. 1/3p.

B. $1/p^3$.

C. 3/p.

D. 1/p.

10. (L.O.1.2) Find in-order traversal of a binary tree with pre-order ADEBJCFHIG and post-order EJBDHIFGCA

A. ADJBEHFICG

B. EDJBAHFICG

C. EDJBAHFCIG

D. EDJBAFHICG

11. (L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G. How many ways can they get out of the elevator on the remaining floors if

- (a) every floor has at least one person get out and,
- (b) the order of the people coming out on the same floors does not matter

A. 1913.

B. 8400.

C. 1319.

D. 4800.

12. (L.O.2.2) Consider a team chess match, knowing that each team has 5 players, and each player will have to play games against every player from the opponent team. The team that has more wins in the match is the winning team, and the probability of winning for each player is the same. What kind of graph represents the match, and what is the probability of there being a winning team?

A. $K_{5,5}, 0.5$

B. All the others answers are incorrect

C. $W_{5.5}$, 0.422

D. $K_{5.5}$, 0.589

13. (L.O.2.2) The number of relations that are both reflexive and symmetric on a set of 2023 elements is

A. $2^{\frac{2022*2023}{2}}$

 $^{\mathbf{R}}$ 2^{2023^2}

C. $2^{\frac{2022*2023}{2}+1}$

D. $2^{2022*2023}$

14. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?

A. 11

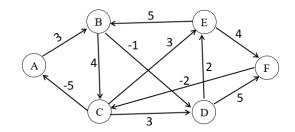
B. 12

C. 12.5

D. 13

Stu.ID: Stu.Fullname: Page: 2

15. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

- A. The shortest paths do not exist.
- B. 3, 5, 2, 4, and 7.

C. 3, 7, 2, 4, and 7.

D. 3, 7, 4, 5, and 7.

For questions 16–20, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

16. (L.O.2.2) Assume that the index of the cell (or the graph's edge) in the adjacency matrix will be indexed by order of alphabet and number (from 1 to the end). For instance, cell (A, B) is indexed (1, 2), cell (A, A) is (1, 1), cell (A, C) is (1, 3), ..., (G, G) is (7, 7).

Start from A; the initialize step is Step 0; find the value of the Bellman-Ford algorithm's Third step (Step 3). Note that the weight of an edge is not fixed; instead, it will be changed following the rule:

The weight of the cell/edge where the sum of the row and column index is an odd number will be reduced by 1 after every 2 step of calculation (if the weight is 1, it cannot reduce more). For instance, at the first and second steps, the value of cell (1,2) a.k.a edge (A,B) is 8, and when calculating at the third and fourth steps, it will be 7 and will be further decreased to 6 when calculating fifth and sixth, ...

- A. 0,3,2,1,3,1,2
- B. 0,4,3,1,4,1,2
- C. 0,8,3,1,5,2,3
- D. 0,5,3,1,4,2,3

17. (L.O.2.2) Can we remove an edge from H to create H_1 so that H_1 has an Euler circuit? If yes, what edge can we remove?

A. Cannot

- B. Can, remove edge BG
- C. All the other choices are incorrect
- D. Can, remove edge AF

18. (L.O.2.2) Apply BFS from B to find a spanning tree of H. What is the total weight of this spanning tree? Note: When choosing between multiple vertices, choose according to the alphabet in ascending order.

A. 16

B. 22

C. 12

D. 9

19.	(L.O.2.2) Find the minimum s	spanning tree of H with the	he root D , we follow the cr	iteria:
	• If a child is earlier than	its parent in the alphabet,	it is a left child, else it is	a right child
	• There can be more than	1 left child or more than	1 right child.	
	• When choosing between the alphabet list.	multiple edges, select the	edge with the earliest alph	abet in ascending order of
	What is the in-order traverse A. F C A D G B E		C. C F A B G E D	D. C F A D B G E
20.	(L.O.2.2) Given a set X consprobability of choosing a grap the vertices is the same		_	_
	A. 0.4444	B. 0.4222	C. 0.0066	D. 0.0063
21.	(L.O.3.1) An athlete decides accident or bad weather, he season, the possibility of a day Know that the chance of this normal weather. Find the probability of A. 87.9%.	e will immediately stop clin y with good weather is 60° athlete having an acciden	mbing and return to A . As $\%$, normal weather is 30% at in good weather is 1% ,	ecording to the survey this, and bad weather is 10%.
22.	(L.O.3.1) Let $G = (V, E)$ be a weights $w(i, j)$ are assigned as			edges of the graph and its
		$E = \{(i, j) j = i + 1, \text{ or } \}$	$j=3i\},\ w(i,j)=1,$	
	for all $(i, j) \in E$. The shortest	path in G from vertex u =	= 1 to vertex $v = 100$ has	length
	A. 33.	B. 4.	C. 27.	D. 7.
23.	(L.O.3.1) Assume the populat given that person tests positive positive, and a 0.02% chance probability.	ve for B? Assume that the	re is a 99.9% chance a per	cson with the disease tests
	A. 52.25%	B. 33.31%	C. 75.53%	D. 18.02%
24.		e following sequences can r 5,6,4,4,2,2; (III) 8,7,7,6,4,	not be the degree sequence 2,2,1,1; (IV)9,9,6,6,6,6,5,5	e of any graph? 4,3,2
	A. II and IV.	B. I and IV.	C. I only.	D. II and III.
25.	 (L.O.2.2) Given a W₃ graph, to of each edge is the sum of its an 5. What is the expectation of A. 16 	adjacency vertex. For insta	ance, the edge between ver	tex 2 and 3 has a value of

20. B.

25. B.

8. C. 21. A. 1. A. 15. B. 2. C. 9. D. 22. D. 16. B. 3. A. 10. B. 17. B. 4. B. 11. B. 23. B. 5. A. 12. B. 18. B. 24. D. 13. A. 19. B. 6. D.

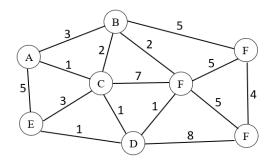
14. B.

7. B.

Lecturer:	(Date)	Approved by: (Date)	
(Signature and Full	name)	(Signature and Fullname)	

ВК	FINAL I	EXAM	Semester / Academic year Date	2	2022-2023 30/05/2023
BK THACK	Course title	Discrete Str	ructure for Computing		, ,
UNIVERSITY OF TECHNOLOGY	Course ID	CO1007			
FACULTY OF CSE	Duration	80 mins	Question sheet code		2226
Notes: - Students do not use course materi	als except one	A4 hand-wri	iting document.		

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.
- 1. (L.O.3.2) Consider the weighted undirected graph G



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

A. 18

B. 30

C. 12

- D. 1
- 2. (L.O.3.1) A grocery store has a promotion for customers when shopping. The promotional gift is any 10 toothbrushes from Colgate, Oral-B, and P/S brands. How many different ways to create promotional gifts?
 - **A**. 23

B. 66

C. 87

D. 12

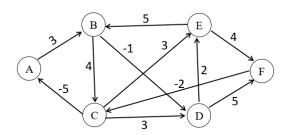
For questions 3–7, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

3.	(L.O.2.2) Assume that the in order of alphabet and number $(1,1)$, cell (A,C) is $(1,3)$,	er (from 1 to the end). F		-
	Start from A; the initialize s 3). Note that the weight of a The weight of the cell/edge	tep is Step 0; find the van edge is not fixed; instead	ad, it will be changed follo	wing the rule:
	by 1 after every 2 step of calc second steps, the value of cell it will be 7 and will be further	culation (if the weight is 1 $(1,2)$ a.k.a edge (A,B) is	, it cannot reduce more). s 8, and when calculating a	For instance, at the first and at the third and fourth steps,
	A. 0,4,3,1,4,1,2	B. 0,3,2,1,3,1,2	C. 0,8,3,1,5,2,3	D. 0,5,3,1,4,2,3
4.	(L.O.2.2) Can we remove an every remove?	edge from H to create H_1	so that H_1 has an Euler of	circuit? If yes, what edge can
	A. Can, remove edge B C. All the other choices		B. CannotD. Can, remove edge	AF
5.	(L.O.2.2) Apply BFS from B Note: When choosing betwee A. 22			
6.	(L.O.2.2) Find the minimum			
	• If a child is earlier than		,	
		-	,	is a right chird
	• There can be more than		J	
	• When choosing between the alphabet list.	n multiple edges, select th	e edge with the earliest al	phabet in ascending order of
	What is the in-order traverse			
7.	A. A C F D B E G (L.O.2.2) Given a set X con probability of choosing a gra the vertices is the same	sisting of sub-graphs S v	_	A of degree 4. What is the
	A. 0.4222	B. 0.4444	C. 0.0066	D. 0.0063
8.	(L.O.3.1) Let $G = (V, E)$ be weights $w(i, j)$ are assigned a			ne edges of the graph and its
		$E = \{(i, j) j = i + 1, c \}$	or $j = 3i$ }, $w(i, j) = 1$,	
	for all $(i, j) \in E$. The shortes A. 4.	t path in G from vertex a B. 33.	u = 1 to vertex $v = 100$ has C. 27.	as length D. 7.
9.	(L.O.1.2) How many arrange A. 5660	ments of the letters in AA B. 5880	BRACADABRA have no A	A adjacent to a B? D. 3360
10.	(L.O.2.2) Given a W_3 graph, of each edge is the sum of its 5. What is the expectation of	adjacency vertex. For install the total value of a span	stance, the edge between aning tree chosen from this	vertex 2 and 3 has a value of s W_3 ?
	A. 15	B. 16	C. 15.5	D. 14.25
11.	(L.O.2.2) Consider a team che play games against every play winning team, and the probamatch, and what is the probamatch.	yer from the opponent te bility of winning for each	am. The team that has m player is the same. What	ore wins in the match is the
	A. All the others answer C. $W_{5.5}$, 0.422	=	B. $K_{5,5}$, 0.5 D. $K_{5,5}$, 0.589	
12.	(L.O.1.2) How many ways a \$50, and \$100 bills? Assume denomination are indistinguish.	that the order in which	the bills are chosen does	not matter; the bills of each
	A. 462	В. 1287	C. 330	D. 792
Stu.I	D:	Stu.Fullname:		Page: 2

- 13. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?
 - (I) 7,6,5,5,5,4,4,2,2; (II) 7,6,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV) 9,9,6,6,6,6,5,4,3,2
 - A. I and IV.
- B. II and IV.
- C. I only.
- D. II and III.

14. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

A. 3, 5, 2, 4, and 7.

B. The shortest paths do not exist.

C. 3, 7, 2, 4, and 7.

- D. 3, 7, 4, 5, and 7.
- 15. (L.O.3.1) Assume the population's disease B ratio is 1/10000. What is the probability of a person having B, given that person tests positive for B? Assume that there is a 99.9% chance a person with the disease tests positive, and a 0.02% chance a person without B tests positive for it. Choose the best approximate of the probability.
 - A. 33.31%
- B. 52.25%
- C. 75.53%
- D. 18.02%
- 16. (L.O.3.1) An athlete decides to climb the mountain on 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 is 60%, normal weather is 30%, and bad weather is 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 B.
 - A. 2.1%.
- B. 87.9%.
- C. 97.9%.
- D. 12.1%.
- 17. (L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves?
 - A. 33

B. 30

C. 25

- D. 28
- 18. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

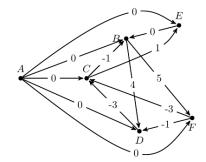
Vertex	Adjacent vertices
a	b, d, f
b	a, c, e
c	b, d, h
d	a, c, g
e	b, f, h
f	a, e, g
g	d, f, h
h	c, e, g

Which of the following assessments is correct?

A. The graph is bipartite.

- B. All answers are correct.
- C. The graph has a Hamilton circuit.
- D. The graph has no Euler circuit.
- 19. (L.O.2.2) The number of relations that are both reflexive and symmetric on a set of 2023 elements is
 - A. 2^{2023^2} .
- B. $2^{\frac{2022*2023}{2}}$.
- C. $2^{\frac{2022*2023}{2}+1}$.
- D. $2^{2022*2023}$.

20. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

- A. -4, -5, 1, -1, 0.
- B. Another answer.
- C. -5, -4, -1, -3, 0. D. -4, -4, -1, -2, 0.
- 21. (L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G. How many ways can they get out of the elevator on the remaining floors if
 - (a) every floor has at least one person get out and,
 - (b) the order of the people coming out on the same floors does not matter
 - A. 8400.
- B. 1913.
- C. 1319.
- D. 4800.

22. (L.O.2.2) What is the probability that

$$x + y + z \equiv 1 \mod p$$
,

when x, y and z are chosen uniformly at random from $\{0, \ldots, p-1\}$ with an odd prime number p?

- A. $1/p^3$.
- B. 1/3p.
- C. 3/p.

- D. 1/p.
- 23. (L.O.1.2) Find in-order traversal of a binary tree with pre-order ADEBJCFHIG and post-order EJBDHIFGCA
 - A. EDJBAHFICG
- B. ADJBEHFICG
- C. EDJBAHFCIG
- D. EDJBAFHICG
- 24. (L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s?

B. 246.

C. 249.

- 25. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?
 - A. 12

B. 11

C. 12.5

D. 13

20. C.

25. A.

1. D. 7. A. 14. A. 21. A. 8. D. 15. A. 2. B. 22. D. 9. B. 16. B. 3. **A**. 10. A. 17. C. 23. A. 4. A. 11. A. 18. B. 24. A. 5. A. 12. A. 19. B.

13. D.

6. **A**.

Lecturer:	(Date)		Approved l	by: (Date)		
(Signature and Fulln	ame)		(Signature a	$nd\ Full name)$		
		TINIAT	TOSZ A D A	Semester / Academic year	2	

•	FINAL F	EX A M	Semester / Academic year	2 2022-2023
BK TR-HCM	LINALI		Date	30/05/2023
	Course title	Discrete Str	ructure for Computing	
UNIVERSITY OF TECHNOLOGY	Course ID	CO1007		
FACULTY OF CSE	Duration	80 mins	Question sheet code	2227
Notes: - Students do not use course materi	als except one	A4 hand-wri	ting document.	

- Submit the question sheet together with the answer sheet.
- Choose the best answer (only 1) for each question.
- 1. (L.O.2.2) Given a discrete structure final test with 5 questions on Counting, 5 questions on Probability, 4 questions on Graph, 4 questions on Connectivity, and 7 on Tree. A sample student who has 30% of doing a Counting question right, 40% of doing a Probability question right, 50% of doing a Graph question right, 60% of doing a Connectivity question wrong, and 70% of doing a Tree question right. What is the expected number of correct questions this student can have?
 - A. 12

B. 12.5

C. 11

- D. 13
- 2. (L.O.1.2) How many arrangements of the letters in ABRACADABRA have no A adjacent to a B?
 - A. 5660

B. 5520

C. 5880

- D. 3360
- 3. (L.O.2.2) Consider a team chess match, knowing that each team has 5 players, and each player will have to play games against every player from the opponent team. The team that has more wins in the match is the winning team, and the probability of winning for each player is the same. What kind of graph represents the match, and what is the probability of there being a winning team?
 - A. All the others answers are incorrect
- B. $W_{5.5}$, 0.422

C. $K_{5,5}$, 0.5

- D. $K_{5,5}$, 0.589
- 4. (L.O.3.1) An athlete decides to climb the mountain on 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 is 60%, normal weather is 30%, and bad weather is 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 B.
 - A. 2.1%.
- B. 97.9%.
- C. 87.9%.
- D. 12.1%.
- 5. (L.O.3.1) Let G = (V, E) be a weighted directed graph with $V = \{1, ..., 100\}$. The edges of the graph and its weights w(i, j) are assigned according to the following rule:

$$E = \{(i, j) | j = i + 1, \text{ or } j = 3i\}, \ w(i, j) = 1,$$

for all $(i, j) \in E$. The shortest path in G from vertex u = 1 to vertex v = 100 has length

A. 4.

B. 27.

C. 33.

- D. 7
- 6. (L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G. How many ways can they get out of the elevator on the remaining floors if
 - (a) every floor has at least one person get out and,
 - (b) the order of the people coming out on the same floors does not matter
 - A. 8400.
- B. 1319.
- C. 1913.
- D. 4800.

For questions 7–11, consider the following adjacency matrix for the simple undirected graph H (the weight 0 means no connection):

	A	В	С	D	Е	F	G
A	0	8	4	1	0	2	0
В	8	0	0	0	5	0	2
С	4	0	0	9	0	1	3
D	1	0	9	0	4	0	2
Е	0	5	0	4	0	7	1
F	2	0	1	0	7	0	6
G	0	2	3	2	1	6	0

7. (L.O.2.2) Assume that the index of the cell (or the graph's edge) in the adjacency matrix will be indexed by order of alphabet and number (from 1 to the end). For instance, cell (A, B) is indexed (1, 2), cell (A, A) is (1, 1), cell (A, C) is (1, 3), ..., (G, G) is (7, 7).

Start from A; the initialize step is Step 0; find the value of the Bellman-Ford algorithm's Third step (Step 3). Note that the weight of an edge is not fixed; instead, it will be changed following the rule:

The weight of the cell/edge where the sum of the row and column index is an odd number will be reduced by 1 after every 2 step of calculation (if the weight is 1, it cannot reduce more). For instance, at the first and second steps, the value of cell (1,2) a.k.a edge (A,B) is 8, and when calculating at the third and fourth steps, it will be 7 and will be further decreased to 6 when calculating fifth and sixth, ...

A. 0,4,3,1,4,1,2

B. 0,8,3,1,5,2,3

C. 0,3,2,1,3,1,2

D. 0,5,3,1,4,2,3

8. (L.O.2.2) Can we remove an edge from H to create H_1 so that H_1 has an Euler circuit? If yes, what edge can we remove?

A. Can, remove edge BG

B. All the other choices are incorrect

C. Cannot

D. Can, remove edge AF

9. (L.O.2.2) Apply BFS from B to find a spanning tree of H. What is the total weight of this spanning tree? Note: When choosing between multiple vertices, choose according to the alphabet in ascending order.

A. 22

B. 12

C. 16

D. 9

10. (L.O.2.2) Find the minimum spanning tree of H with the root D, we follow the criteria:

• If a child is earlier than its parent in the alphabet, it is a left child, else it is a right child

• There can be more than 1 left child or more than 1 right child.

• When choosing between multiple edges, select the edge with the earliest alphabet in ascending order of the alphabet list.

What is the in-order traverse of the obtained tree?

A. ACFDBEG

B. CFABGED

C. FCADGBE

D. CFADBGE

11. (L.O.2.2) Given a set X consisting of sub-graphs S with 6 edges and a vertex A of degree 4. What is the probability of choosing a graph from X and that is a spanning tree? know that the probability of choosing the vertices is the same

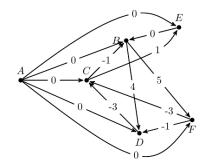
A. 0.4222

B. 0.0066

C. 0.4444

D. 0.0063

12. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

A. -4, -5, 1, -1, 0.

B. -5, -4, -1, -3, 0.

C. Another answer.

D. -4, -4, -1, -2, 0

13. (L.O.2.2) Given a W_3 graph, the cycle vertices are indexed from 1 to 3, and the middle vertex is 4. The value of each edge is the sum of its adjacency vertex. For instance, the edge between vertex 2 and 3 has a value of 5. What is the expectation of the total value of a spanning tree chosen from this W_3 ?

A. 15

D. 14.25

14. (L.O.3.1) Assume the population's disease B ratio is 1/10000. What is the probability of a person having B, given that person tests positive for B? Assume that there is a 99.9% chance a person with the disease tests positive, and a 0.02% chance a person without B tests positive for it. Choose the best approximate of the probability.

A. 33.31%

B. 75.53%

C. 52.25%

D. 18.02%

15. (L.O.3.1) A grocery store has a promotion for customers when shopping. The promotional gift is any 10 toothbrushes from Colgate, Oral-B, and P/S brands. How many different ways to create promotional gifts?

A. 23

B. 87

C. 66

D. 12

16. (L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves?

B. 25

D. 28

17. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?

(I) 7,6,5,5,5,4,4,2,2;

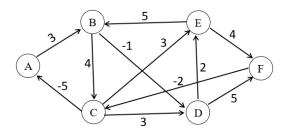
A. I and IV.

(II)7,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV)9,9,6,6,6,6,5,4,3,2 B. I only.

C. II and IV.

D. II and III.

18. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

A. 3, 5, 2, 4, and 7.

B. 3, 7, 2, 4, and 7.

C. The shortest paths do not exist.

D. 3, 7, 4, 5, and 7.

19. (L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s?

B. 249.

C. 246.

20. (L.O.2.2) The number of relations that are both reflexive and symmetric on a set of 2023 elements is A. 2^{2023^2} . B. $2^{\frac{2022*2023}{2}+1}$. C. $2^{\frac{2022*2023}{2}}$. D. $2^{2022*2023}$.

21. (L.O.1.2) Find in-order traversal of a binary tree with pre-order ADEBJCFHIG and post-order EJBDHIFGCA

A. EDJBAHFICG

- B. EDJBAHFCIG
- C. ADJBEHFICG
- D. EDJBAFHICG
- 22. (L.O.1.2) Let's 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 assessments is correct?

A. The graph is bipartite.

B. The graph has a Hamilton circuit.

C. All answers are correct.

- D. The graph has no Euler circuit.
- 23. (L.O.1.2) How many ways are there to select **five bills** from a cash box containing \$1, \$2, \$5, \$10, \$20, \$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each denomination are indistinguishable, and there are at least five bills of each type.

A. 462

B. 330

C. 1287

D. 792

24. (L.O.2.2) What is the probability that

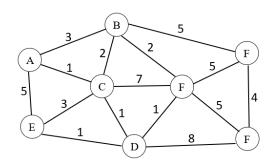
$$x + y + z \equiv 1 \mod p$$
,

when x, y and z are chosen uniformly at random from $\{0, \dots, p-1\}$ with an odd prime number p?

- A. $1/p^3$.
- B. 3/p.

- C. 1/3p.
- D. 1/p.

25. (L.O.3.2) Consider the weighted undirected graph G



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

A. 18

B. 12

C. 30

D. 15

20. C.

25. D.

1. A. 7. A. 14. A. 21. A. 15. C. 8. A. 2. C. 22. C. 16. B. 9. **A**. 3. A. 10. A. 17. D. 23. A. 4. C. 11. A. 18. A. 5. D. 24. D. 12. B. 19. A. 6. A.

13. A.

	(Date)		Approved to (Signature and			
ВК		FINAL I	EXAM	Semester Date	/ Academic year	2 2022-202
TRACK	CITATOT OCAL	Course title	Discrete St	ructure for	Computing	, ,
$egin{aligned} ext{UNIVERSITY OF TE} \ ext{FACULTY OF} \end{aligned}$		Course ID	CO1007			
		Duration	80 mins	1 -	sheet code	222
Notes: - Students do not a - Submit the quest - Choose the best a	ion sheet togethe	r with the ans	wer sheet.	ning docur	nent.	
1. (L.O.2.2) What is the	e probability that	,				
		x + y + z	$\equiv 1 \mod p$,		
when x, y and z are of	chosen uniformly	at random fro	$m \{0, \dots, p - 1\}$	- 1} with a	n odd prime numb	per p?
A. $1/p$.	B. 1/1	p^3 .	\mathbf{C} . $3/p$		D. $1/3p$.	
2. (L.O.2.2) The number A. 2 ^{2022*2023} .	er of relations that $B. \ 2^{20}$			mmetric on $\frac{22*2023}{2}+1$.	a set of 2023 elem D. $2^{\frac{2022*2}{2}}$	
3. (L.O.1.2) Find in-or-	rder traversal o	f a binary t	ree with pr	e-order A	DEBJCFHIG ε	and post-orde
A. EDJBAFH	IICG B. EI	OJBAHFICG	\mathbf{C} . ED	JBAHFC	$^{\prime}IG$ D. $ADJI$	BEHFICG
4. (L.O.3.1) Assume the	e population's dis	ease B ratio is	3 1/10000. W	nat is the p	propability of a be	erson naving E
given that person tes positive, and a 0.02% probability.	chance a person	n without B to	ests positive	9.9% chance for it. Cho	e a person with the ose the best appr	oximate of th
given that person test positive, and a 0.02%	•	n without B to		9.9% chance for it. Cho	e a person with the	oximate of th
given that person tes positive, and a 0.02% probability.	B. 33. decides to climbather, he will imply of a day with good of this athlete	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle	C. 75.5 n on a specific climbing and s 60%, normal cident in good	9.9% chance for it. Cho 53% ic day from d return to al weather	D. 52.259 and A to B. If this of A. According to is 30%, and bad w	oximate of the oximate of the person has a survey this veather is 10% hance is 5% in the oximate of the oximate oxima
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct questions.	B. 33. decides to climbrather, he will imply of a day with good this athleted the probability B. 2.1 screte structure for 4 questions on Coright, 40% of doinectivity question this students.	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle %. Simulatest with Connectivity, and a Probability wrong, and 70	C. 75.5 n on a specific climbing and a 60%, normal cident in good the reaches B. C. 97.5 5 questions and 7 on Trectity question a 60% of doing a 60% of doing a 60% of doing a 60%.	2.9% chance for it. Cho 53% fic day from the return to all weather it. disconnections on Counting the A sample right, 50% on Tree questions.	D. 52.25% In A to B. If this of A. According to is 30%, and bad wis 1%, and this company of the student who has of doing a Graph tion right. What is	oximate of the way of the survey this weather is 10% hance is 5% in the control of the control o
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct question A. 13	B. 33. decides to climbather, he will imply of a day with good this athleted the probability B. 2.1 screte structure for 4 questions on Control of the probability question dectivity question estions this stude B. 12	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle %. Similarly, and the connectivity, and a Probability wrong, and 70 ent can have?	C. 75.3 In on a specific climbing and a 60%, normal cident in good the reaches B. C. 97.3 5 questions and 7 on Trectity question and 7 of doing a C. 12.3	2.9% chance for it. Cho 53% ic day from the return to all weather and weather 19%. on Counting a Tree question of the country	D. 52.259 In A to B. If this of A. According to is 30%, and bad wis 1%, and this company and the second of doing a Graph tion right. What is D. 11	person has another survey this veather is 10% hance is 5% in the survey and the survey this survey and the survey that the survey is 30% of doing question right is the expected
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct questions.	B. 33. decides to climbrather, he will imply of a day with good this athleted the probability B. 2.1 screte structure for 4 questions on Coright, 40% of doinectivity question destions this stude and below the store has a property of the store has a pr	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle %. Timal test with Connectivity, a ng a Probability wrong, and 70 ent can have?	C. 75.5 n on a specific climbing and 60%, normal cident in good the reaches B. C. 97.5 5 questions and 7 on Trectity question and 7 of doing a C. 12.5 tomers when	2.9% chance for it. Cho 53% ic day from the return to all weather it distributed weather it. 29%. on Counting the A sample right, 50% on Tree questions a Tree questions shopping.	D. 52.25% In A to B. If this of A. According to is 30%, and bad wis 1%, and this company of the student who has of doing a Graph tion right. What is D. 11 The promotional	person has another survey this veather is 10% hance is 5% in the survey and the survey this survey and the survey that the survey is 30% of doing question right is the expected
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct question A. 13 7. (L.O.3.1) A grocery	B. 33. decides to climbrather, he will imply of a day with good this athleted the probability B. 2.1 screte structure for 4 questions on Coright, 40% of doinectivity question destions this stude and below the store has a property of the store has a pr	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle %. Timal test with Connectivity, a ng a Probability wrong, and 70 ent can have?	C. 75.5 n on a specific climbing and 60%, normal cident in good the reaches B. C. 97.5 5 questions and 7 on Trectity question and 7 of doing a C. 12.5 tomers when	2.9% chance for it. Cho 53% ic day from the return to all weather it distributions on Counting a Tree question of the chance of	D. 52.25% In A to B. If this of A. According to is 30%, and bad wis 1%, and this company of the student who has of doing a Graph tion right. What is D. 11 The promotional	person has another survey this veather is 10% hance is 5% in the survey and the survey this survey and the survey that the survey is 30% of doing question right is the expected
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct question A. 13 7. (L.O.3.1) A grocery toothbrushes from Control of the cont	B. 33. decides to climbrather, he will imply of a day with good this athleted the probability B. 2.1 screte structure for 4 questions on Coright, 40% of doinectivity question estions this stude B. 12 store has a promolegate, Oral-B, and B. 23 (7, E) be a weighter	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle %. Simal test with Connectivity, and a Probability wrong, and 70 ent can have? motion for cust and P/S brands directed grand	c. 75.3 n on a specific climbing and a 60%, normal sident in good the reaches B. C. 97.3 5 questions and 7 on Tree ity question and 7 of doing a c. 12.3 tomers when so How many C. 87 ph with V =	2.9% chance for it. Cho 53% ic day from the day from the day weather and weather and weather and the day from	D. 52.25% In A to B. If this of A. According to is 30%, and bad wis 1%, and this company and the second and the second are student who has of doing a Graph tion right. What is D. 11 The promotional ways to create product the second are student who has of doing a Graph tion right. What is D. 11 The promotional ways to create product the second are student who has of doing a Graph tion right. What is D. 11	person has any the survey this veather is 10% hance is 5% in the survey and the survey this survey and the survey that is the expected gift is any 10 motional gifts.
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct question A. 13 7. (L.O.3.1) A grocery toothbrushes from Counting Countin	B. 33. A decides to climbrather, he will imply of a day with good this athlete of the probability B. 2.1 Screte structure for 4 questions on Coright, 40% of doinectivity question destions this stude of the probability of the structure for the probability of the structure for the probability of	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle %. Simal test with Connectivity, and a Probability wrong, and 70 ent can have? motion for cust and P/S brands directed grand	c. 75.5 n on a specific climbing and 60%, normal cident in good the reaches B. C. 97.5 5 questions and 7 on Tree ity question and 7 of doing and 8 of doi	2.9% chance for it. Cho 53% fic day from the return to all weather and weather and weather and the second counting and the sec	D. 52.25% In A to B. If this of A. According to is 30%, and bad wis 1%, and this company of the student who has of doing a Graph tion right. What is D. 11 The promotional ways to create products of the edges of the state of	person has any the survey this veather is 10% hance is 5% in the survey and the survey this survey and the survey that is the expected gift is any 10 motional gifts.
given that person test positive, and a 0.02% probability. A. 18.02% 5. (L.O.3.1) An athlete accident or bad we season, the possibility Know that the chance normal weather. Find A. 12.1%. 6. (L.O.2.2) Given a disquestions on Graph, a Counting question 60% of doing a Connumber of correct question A. 13 7. (L.O.3.1) A grocery toothbrushes from Counting Countin	B. 33. A decides to climbrather, he will imply of a day with gree of this athlete of the probability B. 2.1 Screte structure for 4 questions on Coright, 40% of doinectivity question estions this stude of B. 12 Store has a promolegate, Oral-B, and B. 23 (X,E) be a weighter signed according $E=\{$	a without B to 31% the mountain mediately stop ood weather is having an acceptant this athle $\%$. Final test with Connectivity, as a Probability wrong, and 70 ent can have? The motion for cust and P/S brands of directed graph of the following $(i,j) j=i+1$	ests positive C. 75.5 n on a specific climbing and 60%, normal eident in good ete reaches B. C. 97.5 5 questions and 7 on Tree ity question of doing at the common of	0.9% chance for it. Cho $0.53%$ ic day from degree return to all weather $0.5%$ on Counting A. A sample right, $0.50%$ a Tree question different we $0.5%$ shopping. different we $0.5%$	D. 52.259 In A to B. If this of A. According to is 30%, and bad wis 1%, and this company and the student who has of doing a Graph tion right. What is D. 11 The promotional ways to create prospectively. The edges of the student who has of doing a Graph tion right. What is D. 11 The promotional ways to create prospectively. The edges of the student ways to create prospectively.	person has any the survey this veather is 10% hance is 5% in the survey and the survey this survey and the survey that is the expected gift is any 10 motional gifts.

9.	,	ts adja	cency	verte	ex. Fo	r inst	ance,	the e	dge be	and the middle vertex is 4. The value etween vertex 2 and 3 has a value of this W_2 ?
	A. 14.25		15	varue	oras	раш		15.5	OSCII I	D. 16
Fo	r questions 10–14, consider t	he follo	owing		ency ns no				imple	undirected graph H (the weight 0
			A	В	С	D	Е	F	G	
		A	0	8	4	1	0	2	0	
		В	8	0	0	0	5	0	2	
		С	4	0	0	9	0	1	3	
		D	1	0	9	0	4	0	2	
		Е	0	5	0	4	0	7	1	
		F	2	0	1	0	7	0	6	
		G	0	2	3	2	1	6	0	
10	(I () 2.2) Assume that the	indor o	f the	aall (on +bc	, cruo ro	b'a oc	1 _{ma}) ;	n tha	discovery matrix will be indexed by
10. (L.O.2.2) Assume that the index of the cell (or the graph's edge) in the adjacency matrix will be indexed by order of alphabet and number (from 1 to the end). For instance, cell (A, B) is indexed $(1, 2)$, cell (A, A) is										
	(1,1), cell (A,C) is $(1,3)$,, (G,G) is $(7,7)$. Start from A ; the initialize step is Step 0; find the value of the Bellman-Ford algorithm's Third step (Step									
	3). Note that the weight of an edge is not fixed; instead, it will be changed following the rule:									
	The weight of the cell/edge where the sum of the row and column index is an odd number will be reduced									
	by 1 after every 2 step of calculation (if the weight is 1, it cannot reduce more). For instance, at the first second steps, the value of cell $(1,2)$ a.k.a edge (A,B) is 8, and when calculating at the third and fourth									
	it will be 7 and will be further decreased to 6 when calculating fifth and sixth,									

11. (L.O.2.2) Can we remove an edge from H to create H_1 so that H_1 has an Euler circuit? If yes, what edge can

12. (L.O.2.2) Apply BFS from B to find a spanning tree of H. What is the total weight of this spanning tree? Note: When choosing between multiple vertices, choose according to the alphabet in ascending order.

• If a child is earlier than its parent in the alphabet, it is a left child, else it is a right child

• When choosing between multiple edges, select the edge with the earliest alphabet in ascending order of

C. 0,8,3,1,5,2,3

D. Cannot

B. Can, remove edge BG

 \mathbf{C} . \mathbf{C} \mathbf{F} \mathbf{A} \mathbf{B} \mathbf{G} \mathbf{E} \mathbf{D}

C. 0.0066

D. 0,3,2,1,3,1,2

D. FCADGBE

D. 0.4444

B. 0,4,3,1,4,1,2

13. (L.O.2.2) Find the minimum spanning tree of H with the root D, we follow the criteria:

B. ACFDBEG

B. 22

• There can be more than 1 left child or more than 1 right child.

B. 0.4222

A. 0,5,3,1,4,2,3

the alphabet list.

A. CFADBGE

the vertices is the same
A. 0.0063

A. Can, remove edge AF

C. All the other choices are incorrect

What is the in-order traverse of the obtained tree?

we remove?

A. 9

14. (L.O.2.2) Given a set X consisting of sub-graphs S with 6 edges and a vertex A of degree 4. What is the probability of choosing a graph from X and that is a spanning tree? know that the probability of choosing

15. (L.O.1.2) The degree sequence of a simple graph is the sequence of the degrees of the nodes in the graph in decreasing order. Which of the following sequences can not be the degree sequence of any graph?

(I) 7,6,5,5,5,4,4,2,2; (II)7,6,6,6,4,4,2,2; (III) 8,7,7,6,4,2,2,1,1; (IV)9,9,6,6,6,6,5,4,3,2

A. II and III.

B. I and IV.

C. I only.

D. II and IV.

16. (L.O.2.2) Consider a team chess match, knowing that each team has 5 players, and each player will have to play games against every player from the opponent team. The team that has more wins in the match is the winning team, and the probability of winning for each player is the same. What kind of graph represents the match, and what is the probability of there being a winning team?

A. $K_{5.5}$, 0.589

B. All the others answers are incorrect

C. $W_{5.5}$, 0.422

D. $K_{5,5}$, 0.5

17. (L.O.1.2) How many arrangements of the letters in ABRACADABRA have no A adjacent to a B?

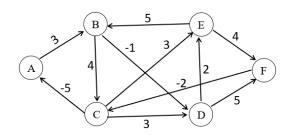
A. 3360

B. 5660

C. 5520

D. 5880

18. (L.O.3.2) Consider the weighted directed graph G



The total weights of the edges of the shortest paths from vertex A to vertices B, C, D, E, and F, respectively, are

A. 3, 7, 4, 5, and 7.

B. 3, 5, 2, 4, and 7.

C. 3, 7, 2, 4, and 7.

D. The shortest paths do not exist.

19. (L.O.1.2) How many ways are there to select five bills from a cash box containing \$1, \$2, \$5, \$10, \$20, \$50, and \$100 bills? Assume that the order in which the bills are chosen does not matter; the bills of each denomination are indistinguishable, and there are at least five bills of each type.

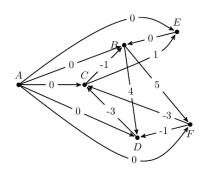
A. 792

B. 462

C. 330

D. 1287

20. (L.O.1.2) Given the following graph,



What is the shortest path (total weight) from A to the remaining vertices B, C, D, E, F:

A. -4, -4, -1, -2, 0. B. -4, -5, 1, -1, 0. C. -5, -4, -1, -3, 0. D. Another answer.

21. (L.O.2.2) A building has a ground floor G and other four floors marked 1,2,3,4. Seven people get in the elevator at G. How many ways can they get out of the elevator on the remaining floors if

(a) every floor has at least one person get out and,

(b) the order of the people coming out on the same floors does not matter

A. 4800.

B. 8400.

C. 1319.

D. 1913.

22. (L.O.2.2) How many binary strings of length 8 do not contain at least six consecutive 1s?

A. 250.

B. 248.

Stu.ID: ______ Stu.Fullname: _____ Page: 3

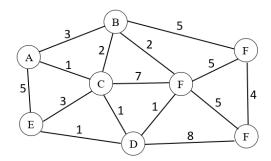
- 23. (L.O.3.1) How many internal vertices are in a full 5-ary tree with 101 leaves?
 - **A**. 28

B. 33

C. 25

D. 30

24. (L.O.3.2) Consider the weighted undirected graph G



What is the total weight of the minimum spanning tree rooted at A obtained using Prim's algorithm?

A. 15

B. 18

C. 12

- D. 30
- 25. (L.O.1.2) Let's consider an undirected graph given by the following adjacency list.

Vertex	Adjacent vertices					
\overline{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 assessments is correct?

- A. The graph has no Euler circuit.
- C. The graph has a Hamilton circuit.
- B. The graph is bipartite.
- D. All answers are correct.

20. C.

25. D.

8. **A**. 1. A. 14. B. 21. B. 2. D. 15. A. 9. B. 22. B. 3. B. 16. B. 10. B. 4. B. 23. C. 17. D. 11. B. 5. D. 18. B. 24. A. 12. B. 6. B. 19. B.

13. B.

7. D.