Republic of the Philippines
SULTAN KUDARAT STATE UNIVERSITY
College of Computer Studies
Isulan Campus, Isulan, Sultan Kudarat

CS 114 – Discrete Structures II
MIDTERM EXAMINATION
1st Semester SY 2024-2025

Name: _____ **Contact No:** _____

General Instructions:
1. Write all your answers in the provided space.
2. Write neatly and legibly using a black or a blue pen.
3. You may use the blank spaces in your questionnaire for your computation.

Test I: Modified True or False (30 pts, 3 pts each)
Instruction: Write **TRUE** if the statement is correct or write **FALSE** if the statement is incorrect in the space provided before the number. If the statement is FALSE, change the underlined word or phrase to make the statement correct. Write the **CORRECT AND COMPLETE** statement in the space provided below each item.

_____ 1. In programming, recursion refers to a function calling itself..

_____

_____ 2. The Fibonacci series of numbers is an example of a recursion.

_____

_____ 3. The following code shows an iterative procedure.

```
def exponents(x, n):
    if (n<1)
        return 1
    else
        return x * exponents(x, n -1)
```

_____

_____ 4. The sum of the elements of a sequence is called a series.

_____

_____ 5. A path is a walk in which all the edges e_j are distinct, that is, no repeated edges.

_____

_____ 6. Not all circuits and cycles are trails.

_____

_____ 7. Graphs can be used to illustrate the connection/linkages of pages in web development.

_____

_____ 8. Undirected graphs can be used in representing intra-city road network with one-way lanes.

_____

_____ 9. If the graph is directed, the adjacency matrix is a symmetric matrix along the main diagonal, thus, an upper (or lower) triangle matrix is sufficient to represent the graph.

_____

_____

_____ 10. The incidence matrix of a digraph contains values 0 when there is no incidence to vertex v_i to/from edge e_j, 1 if there is a an edge e_j incident to vertex v_i, and -1 if there is an edge e_j from v_i.

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_____

Test II: Multiple Choice (30 pts, 2 pts each)
Instruction: Write the letter corresponding to your best choice of answer. Write clearly in **CAPITAL LETTERS**.

_____ 11. Which of the following is an example of a recursion?

A. factorial
B. fractals
C. exponents
D. None of the above.

_____ 12. What do you call a function from the natural numbers into some predetermined set?
A. term
B. sequence
C. series
D. None of the above.

_____ 13. Which of the following a series?

A. $\sum_{k=0}^{n-1}(a+kd)=\frac{n}{2}[2a+(n-1)d]$

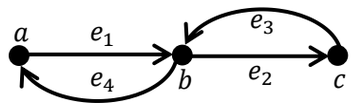
B. $\sum_{k=0}^{\infty}(a+kd)=\infty$, for $d>0$

C. $\sum_{k=0}^{\infty}(a+kd)=-\infty$, for $d<0$

D. All of the above.

_____ 14. In mathematics, what is a graph?
A. A graph, G, is a collection of vertices/nodes, V, and edges/arcs, E.
B. A graph is an ordered collection of objects.
C. A graph is a declarative statement that can either be true or false.
D. None of the above

_____ 15. Which of the following statements is true about the characteristics of the graph below?
A. e_1 is incident with a and b
B. a is incident from b
C. e_3 is incident to c
D. All of the above



_____ 16. Which of the following statements about walks is true?
A. All walks are paths.
B. All trails are walks.
C. All circuits are paths.
D. None of the above

_____ 17. In which of the following scenario or application can a model of a directed graph be used?
A. Linkages of webpages in a website.
B. Map of inter-city bus routes.
C. Diagram of a computer network.
D. None of the above

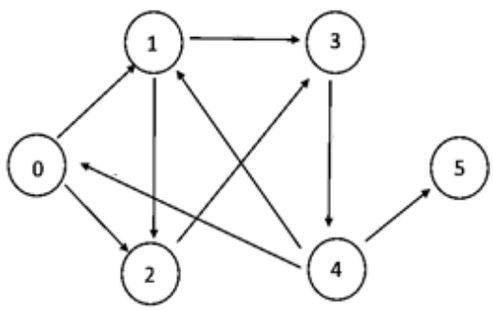
_____ 18. When you want to determine the quickest route from Starting Point A to Destination Point B, which type of walk should you use to model it?
A. Path
B. Cycle
C. Trail
D. Circuit

_____ 19. From the graph in item 15, which of the following is a path?
A. $w_1 = a, b, c, b, c, b, a, b$
B. $w_2 = a, b, c, b, a$
C. $w_3 = a, b, c$
D. None of the above

_____ 20. From the graph in item 15, which of the following is a circuit that is not a cycle?
A. $w_1 = b, c, b, a, b$
B. $w_2 = a, b, a$
C. $w_3 = c, b, a$
D. None of the above

_____ 21. Which of the following is not true about the adjacency matrix of an undirected graph?
A. The adjacency matrix of an undirected graph is a symmetric matrix about the main diagonal.
B. The adjacency matrix of an undirected graph can be an upper (or lower) triangular matrix.
C. The adjacency matrix of an undirected graph can be a diagonal matrix.
D. None of the above

_____ 22. In the digraph on the right, which of the following is the correct adjacent matrix representation? (In the matrices below, the columns are from 0 to 5 (left to right) and the rows are from 0 to 5 (top to bottom).)



A. $\begin{bmatrix} 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

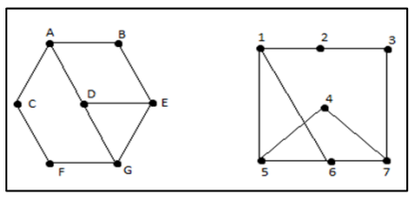
C. $\begin{bmatrix} 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

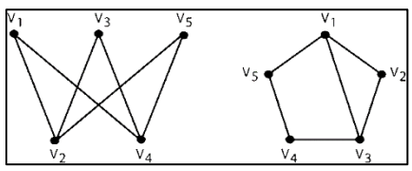
D. None of the above.

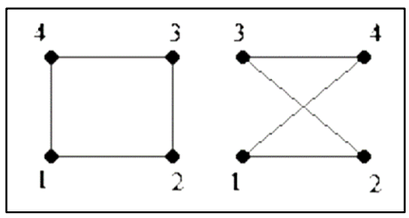
_____ 23. Which of the following is true about undirected graphs?
- A. It's adjacency matrix is diagonally symmetric.
- B. It is always isomorphic.
- C. It always has multiple edges.
- D. None of the above

_____ 24. In which of the following applications can graph isomorphism be used?
- A. Pattern recognition
- B. Gene Matching
- C. Fingerprint scanning
- D. All of the above

_____ 25. Which of the following pairs of graphs are isomorphic?

A. 

B. 

C. 

D. None of the above

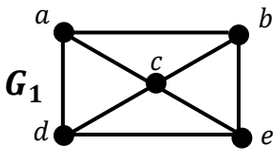
Test III: Essay/Problem Solving: (40 pts)

26. What is a graph? What makes a graph? What does it do? When do you use it? Where do you use it? (10 pts)

27. Give an example of each of the following walks with length of at least 4 from the given the undirected graph. (3 pts each)

a. A walk that is not a trail

_____



b. A path

_____

28. Give an example of each of the following walks with length of at least 3 from the given directed graph. (3 pts each)

a. A trail that is not a path

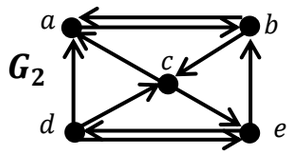
_____

b. A circuit that is not a cycle

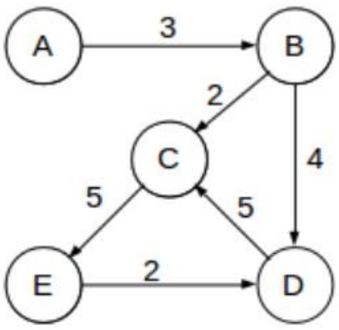
_____

c. A cycle

_____



29. Give the adjacent list and adjacent matrix of the digraph below. (5 pts each list/matrix).



*****End of Exam*****