MATHEMATICS, IT'S FORM AND IMPACT
Section A Hour Exam 1
September 1994

Name ______________________

Each problem is worth 4 points.

Questions 1 through 5 refer to the following graph.

1. Vertex A is adjacent to which other vertices? __________

2. The degree of vertex D is __________

3. Name all the bridges of the graph __________

4. Does the graph of Figure 5.1 have an Euler circuit? ______ Why or why not?

____

5. Does the graph of Figure 5.1 have an Hamilton circuit? ______ Why or why not?

____

Questions 6 and 7 refer to the following situation: An undercover police officer is assigned the job of walking once a night each of the 48 blocks of a certain section of town described by the street grid shown below. The walk starts and ends at A. The officer wants to minimize the total number of blocks she has to walk each night.

6. With stars mark the vertices of odd degree in the graph representing this problem.

7. By adding duplicate edges provide an optimal Eulerization of the graph of Figure 5.4.

8. $\dfrac{150!}{149!} =$ __________

9. In a complete graph with 12 vertices, the total number of Hamilton circuits (including reversals) is

Ans. ________________

Questions 10 through 13 refer to the following situation: A delivery truck must deliver furniture to 4 different locations (A, B, C, and D). The trip must start and end at A. The graph below shows the distance between locations. We want to minimize the total distance traveled.

10. The nearest neighbor algorithm applied to the graph starting with vertex A yields the following solution:

A, __________________________, A

11. The cheapest link algorithm applied to the graph yields the following solution:

A, __________________________, A

12. The repetitive nearest neighbor algorithm applied to the graph yields the following solution:

A, __________________________, A

13. The nearest insertion algorithm applied to the graph starting with vertex A yields the following solution:

$$A, \underline{\hspace{6cm}}, A$$

14. A **tree** is any graph that ____

____ .

15. Use Kruskal's algorithm to find a minimal spanning tree for the graph below. [Mark the edges of the tree without covering up the edge values.]

16. The total weight of the minimal spanning tree for Figure 7.1 is ______________.

17. Which of the following statements is true about Kruskal's algorithm?

Ans. ____________

A) It is an efficient algorithm but it doesn't always give a minimal spanning tree.

B) It is an efficient algorithm and it always gives a minimal spanning tree.

C) It is an inefficient algorithm but it always gives a minimal spanning tree.

D) It is an inefficient algorithm and it never gives a minimal spanning tree.

E) None of the above.

18. How many spanning trees does the graph shown below have?

Ans. ________

Questions 19 through 21 refer to the following digraph.

19. Vertex A has indegree ______, and outdegree ______ .

20. Which of the following is not a circuit in the digraph?

A) A, B, E, A

B) A, C, B, E, A

C) E, D, B, E

D) B, C, B, E, D, B

E) All of the above are circuits in the digraph. Ans. ________

21. Suppose that the vertices of the digraph represent individuals and there is an arc going from vertex X to vertex Y if and only if X "likes" Y. Which of the following statements is not true?

A) B and C like each other.

B) C and D do not like each other.

C) E likes B but B does not like E.

D) E likes A and D but does not like B or C.

E) All of the above statements are true. Ans. ________

Questions 22 through 25 refer to the following project digraph. (The numbers in parentheses represent hours.)

22. The length of the critical path of this project digraph is ______ hours.

23. Which of the statements about the following schedule using three processors is true?

Processor 1	$A(6)$		$D(3)$	id	$G(2)$
Processor 2	$B(4)$	$E(6)$		idle	
Processor 3	$C(8)$		$F(4)$		
Time	0	4	8		12

A) This schedule is an optimal schedule for three processors.

B) This schedule is not an optimal schedule because the project can be scheduled with a completion time of 11 hours.

C) This schedule is an illegal schedule because task F was started before task E was completed.

D) This schedule is an illegal schedule because task E was started before task C was completed.

E) None of the above.

Ans. __________

24. If we use the decreasing time algorithm to schedule this project with two processors, we should start by assigning task ______ to one processor and task ______ to the other one.

25. If we use the critical path algorithm to schedule this project with two processors, we should start by assigning task ______ to one processor and task ______ to the other one.

Extra Credit (10 pts)

Use the critical path algorithm to schedule the project of Figure 8.2 with two processors.

Processor 1	
Processor 2	