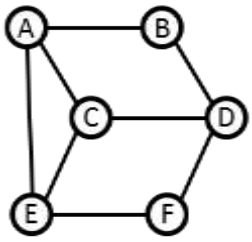
Name _____Test 2, Discrete II, Spring 2018

1) A graph has n vertices and m edges. A particular graph algorithm is going to iterate through every vertex, and run a subroutine that requires $\theta(m)$ runtime. What is the asymptotic runtime of the whole algorithm?
(4 points)

2) Construct the adjacency matrix for the graph below.
(4 points)



3) Convert the decimal number 456 to base 5.
(4 points)

4) Convert the base five number $(123)_5$ to base 10.
(4 points)

5) Add $(234)_7$ and $(15)_7$ in base 7.
(6 points)

6) Multiply $(234)_7$ and $(14)_7$ in base 7.
(6 points)

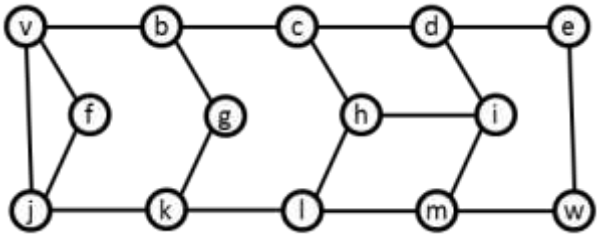
7) Multiple Choice: Do you know what “one’s complement” and “two’s complement” are? Choose the answer that best describes them.

(A) They are methods for calculating the big-Oh runtime of an algorithm
(B) They are methods for representing integers on computers
(C) They are methods for representing graphs on computers
(D) They are methods for negating quantified logical statements

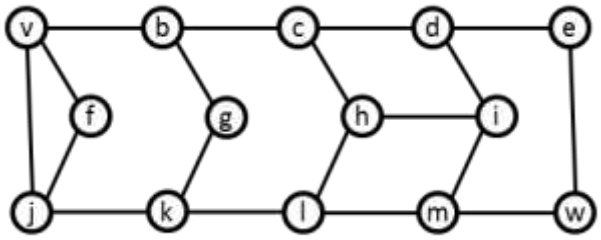
(2 points)

8) It is known that $f(n) = 3n^3 - 2n^2 + 6n$ is $O(n^3)$. Verify this mathematically.
(6 points)

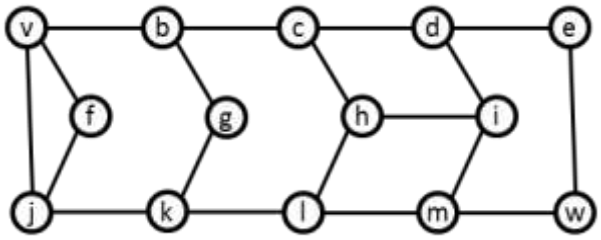
9) On the graph below, find and identify a path from vertex v to w that passes through only vertices of degree 3.
(6 points)



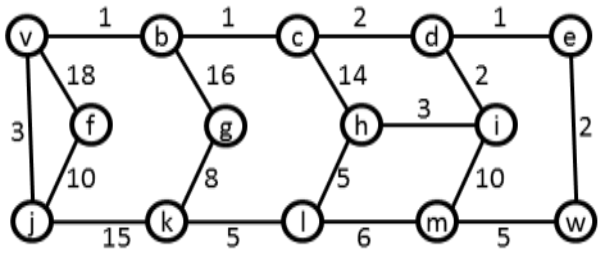
10) On the graph below find a Hamiltonian Cycle or explain/illustrate why one does not exist.
(10 points)



11) On the graph below find an Eulerian Cycle or explain/illustrate why one does not exist.
(10 points)



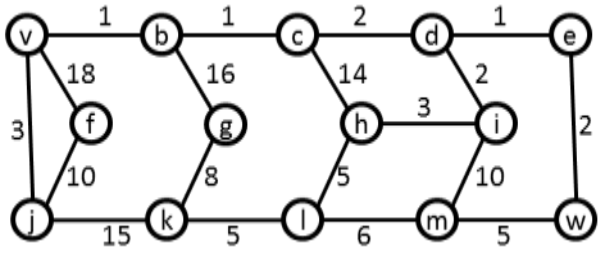
12) On the graph below run Dijkstra's Algorithm to find a shortest path from "v" to "w" or explain/illustrate why one does not exist
(10 points)



13) Find a minimal spanning tree of the graph below. Label the edges in the order in which you add them to the tree. (1, 2, 3, 4, 5, etc).

Which algorithm did you use? Prim's Kruskal's (Circle one)

(10 points)



14) If a binary tree has k levels, find an asymptotic upper bound on the number of vertices in the tree.
(4 points)

15) If a binary tree has k levels, find an asymptotic lower bound on the number of vertices in the tree.
(4 points)

16) If a binary tree has k levels, find an asymptotic upper bound on the number of roots in the tree.
(4 points)

17) Using one of the tree transversal methods, list the order of iteration through this tree.
Which ordering did you use? Preorder Postorder Inorder (Circle one)
(6 points)