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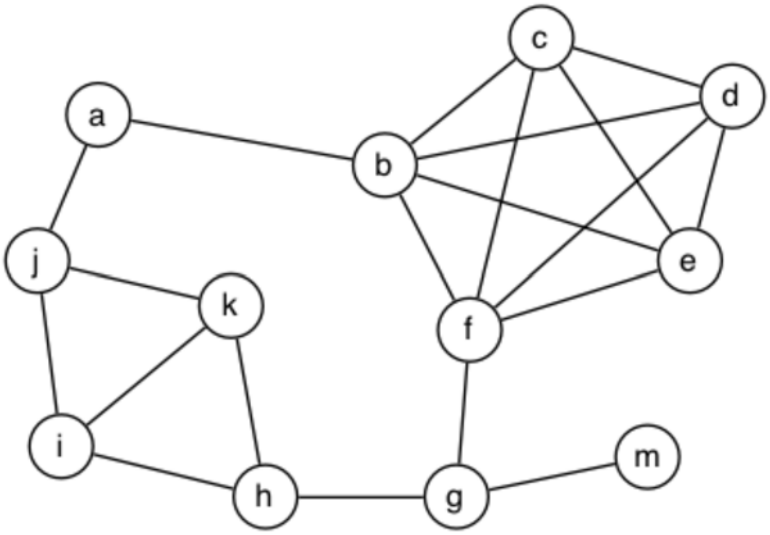
Week 8 Exercises

GraphFundamentals.txt

For the graph:

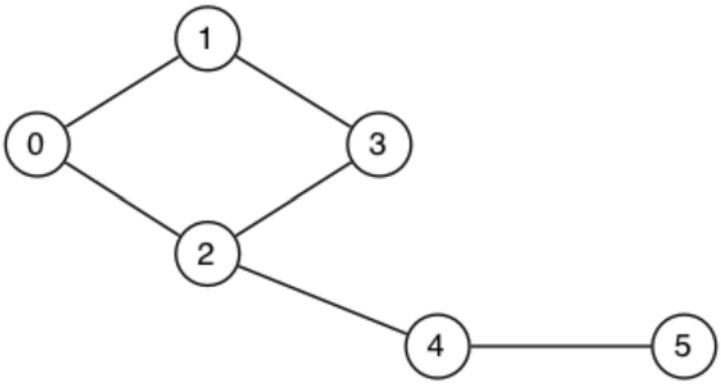


give examples of the **1.** smallest (non-zero) and the **2.** largest of each of the following:

a. path
b. cycle
c. spanning tree
d. vertex degree
e. clique

GraphRepresentations.txt

For the graph:



show how it would be represented by:

a. an adjacency matrix representation ($V \times V$ matrix with each edge represented twice)
b. an adjacency list representation (where each edge appears in two lists, one for v and one for w)

GraphStorageCosts.txt

For the purposes of this exercise you may assume:

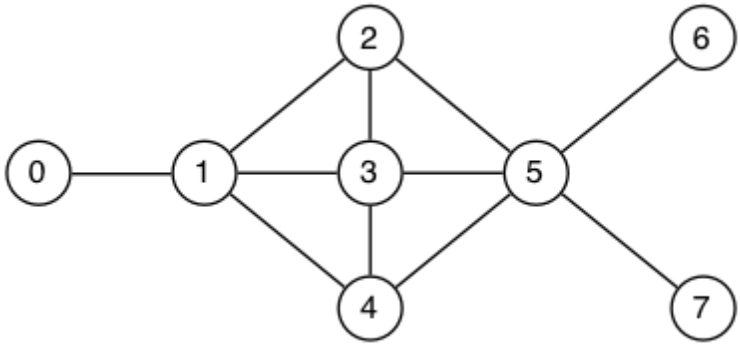
- a pointer is 8 bytes long, an integer is 4 bytes
- a vertex is an integer
- a linked list node stores an integer
- an adjacency matrix element is an integer

For a given graph:

a. Analyse the precise storage cost for the adjacency matrix (AM) representation of a graph of V vertices and E edges.
b. Do the same analysis for the adjacency list (AL) representation.
c. Determine the approximate V:E ratio at which point it is more storage efficient to use an AM representation than an AL representation.
    - If a graph has 100 vertices, how many edges should it have for AM to be more storage efficient than AL?
d. You can save space by making the adjacency matrix an array of bytes instead of integers. What difference does that make to the ratio?

DepthAndBreadthFirst.txt

Consider the following graph:



Show the contents of the stack or queue in a 'search' traversal of the graph using:

a. *depth-first search* starting at vertex 0
b. *depth-first search* starting at vertex 3
c. *breadth-first search* starting at vertex 0
d. *breadth-first search* starting at vertex 3

VisitedArray.txt

Consider the following 2 graphs (the right graph is missing edge 7-8):

```
0--1--2          0--1--2
|  |  |          |  |  |
3--4--5          3--4--5
|  |  |          |  |  |
6--7--8          6--7  8
```

Starting at vertex **0**, and using a *depth-first search* (assume the smallest vertex is selected):

a. compute the visited array for the graph on the left
    - can you deduce a path from vertex **0** to vertex **8** from the visited array?
b. compute the visited array for the graph on the right
    - can you deduce a path from vertex **0** to vertex **8** from the visited array?

Can you draw any conclusions?

Palindrome.c

To finish off, some 'easy' programming and a complexity analysis.

a. Write an algorithm in pseudo code to determine if an input character array of length *n* is a palindrome. A palindrome is a word that reads the same forward and backward. For example, "racecar" is a palindrome.
b. What is the complexity of the algorithm. Justify your answer.
c. Implement your algorithm in C. Your program should accept a single command line argument and check whether it is a palindrome. If there are less or more arguments the program simply returns. Examples of the program executing are:

```
prompt$ ./palindrome racecar
yes
prompt$ ./palindrome cat
no
prompt$ ./palindrome
prompt$
prompt$ ./palindrome cats dogs
prompt$
```

Hint: use strlen().

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