

# CSCI 230 -- PA 12

## MST, Heap Manager, and External Sorting

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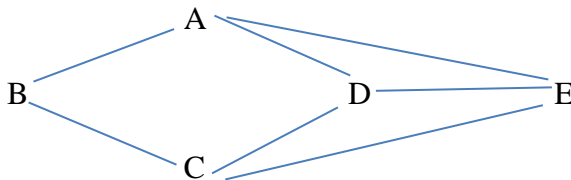
Feel free to discuss and help each other out but does not imply that you can give away your code or your answers! Make sure to read all instructions before attempting this lab.

You can work with a lab partner and each one must submit the same PDF file (include both names in the submission file). Each person must include a brief statement about your contribution to this assignment.

**You must use an appropriate provided template from Canvas and output "Author: Your Name(s)" for all your programs. If you are modifying an existing program, use "Modified by: Your Name(s)".**

**Exercise 1:** Implement one MST algorithm -- either Prim-Jarnik Algorithm or Kruskal Algorithm. Try a small graph below and print out the MST and total cost. Use the following weights:

- (A, B), 3
- (A, D), 5
- (A, E), 5
- (B, C), 4
- (C, D), 2
- (D, E), 5
- (C, E), 3



**Exercise 2:** Do one option below:

**Option A:** Perform Project P-14.1 on page 687 of C++ book in C++ or Java. We will limit to only two of the four algorithms. Furthermore, you can limit your experiment as follow:

- a) Assume that you have an array of 1024 integers (4048 bytes or 4 KB) to manage

- b) Each allocation can be between 5 and 20 integers
- c) Start out with some allocations and deallocations until about half of the memory is being used (do 2 allocations for each random deallocation)
- d) Perform some allocations and stop when an allocation cannot be made
- e) Tally up all available blocks (small blocks not being used) to see how many blocks are still available and how much memory available

**Option B:** Perform file I/O of 100,000 random integers with three options below and collect times (3 different times for input and 3 different times for output).

- text format with one value at a time
- binary format with one value at a time
- binary format with 256 values (1024 bytes) at a time
- you might want to use an array with 100,000 integers
- generate random values, output them to a file, and read them back.
- output first 5 values to the screen to confirm it is reading and writing properly

**Option C:** Implement the simple external sorting using algorithm from the “external sorting” section of the Shaffer book (simple merge with no replacement selection). You will sort a binary file with 100,000 integers and assume a block size is 4KB. Output first 5 values and last 5 values when you are done.

**Question 1:** What is a spanning tree? List some applications of MST.

**Question 2:** Explain some differences between a B-tree and a binary search tree.

**Extra Credit:** If you successfully implemented option C of exercise 2 then you would automatically earn 2 extra credit points. Otherwise, you can implement the other option (A or B) in exercise 2 to earn the extra credit.

**Fill out and turn in the PA submission file for this assignment (save as PDF format).**