Lab Assignment 5
Duration: 3 Weeks

(Memory management and Garbage Collection)

Study the basic concepts of memory management and garbage collection in operating systems: Heap management, allocation and de-allocation of memory, garbage collection methods such as reference counting, mark and sweep methods. Following are study materials for the basics of memory management and garbage collection.

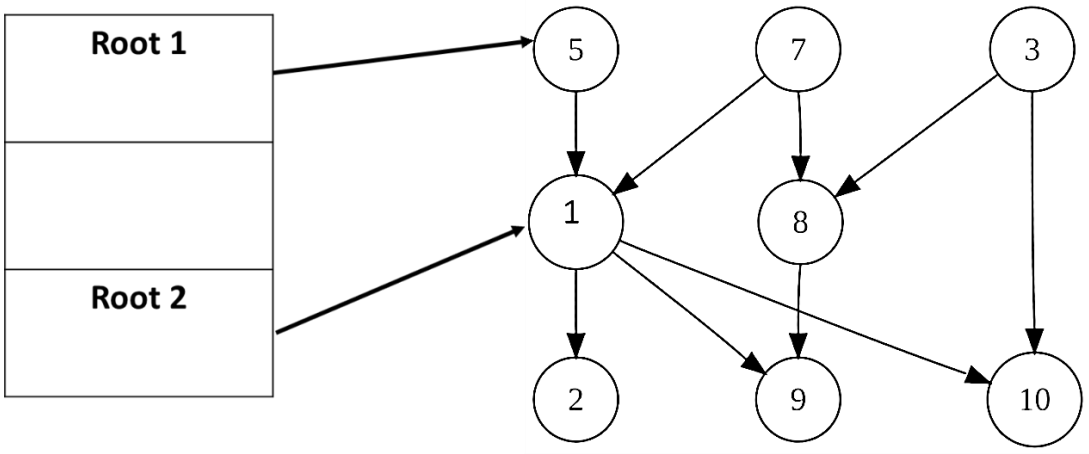
- Book- Operating Systems: Three Easy Pieces:
  - Free space management - https://pages.cs.wisc.edu/~remzi/OSTEP/vm-freespace.pdf

- Garbage Collection (Reference Counting, Mark and Sweep method)
  - 1. https://groups.seas.harvard.edu/courses/cs153/2019fa/lectures/Lec25-Garbage-collection.pdf
  - 2. https://www.cs.cornell.edu/courses/cs4120/2022sp/lectures/36gc/lec38-sp19.pdf
  - 3. Mark Sweep method - https://en.wikipedia.org/wiki/Tracing_garbage_collection#Na%C3%AFve_mark-and-sweep

- **Note: Students can use the concepts and codes related to heap memory management assignment done in the CPL course this semester.**

Problem 1:

Create a simulator for the heap management schema using linked list as shown in the given figure. The program output should display the adjacency matrix for the above schema for each Root 1 and Root 2 separately.



I. After the creation of the heap management schema, write a code and implement the following garbage collection methods to find the garbage nodes in the given heap.

1. Reference Counting method

2. Mark and Sweep method (mark all the nodes of the tree using constant space (i.e. without using either recursion or a stack)

Display the output for both the methods in the form of the adjacency matrix separately. Also show the garbage nodes that are no longer required.

II. For the garbage nodes, implement the merge memory technique of free space management and make sure that the adjacent blocks are merged together. Display the size of the freed and merged memory in terms of bytes.

III. Upload your complete code to the github repository that you created in assignment.

Problem 3:

SVN demonstration: Install Apache SUBVERSION (SVN) client on your system. Then setup a local repository and add one project file to it. (You may refer to the tutorial on official SVN page – https://subversion.apache.org/quick-start). Again, **you do NOT need to demonstrate this process in the weekly lab evaluation.**