**COMP 322/L—Introduction to Operating Systems and System Architecture**

**Assignment #1--Process Creation Hierarchy**

**Objective:**

To simulate process creation and destruction when implemented with linked lists.

**Specification:**

The program creates/destroys child processes based on choosing from a menu of choices, where each choice calls the appropriate procedure, where the choices are:

1) Enter parameters

2) Create a new child process

3) Destroy all descendants of a process

4) Quit program and free memory

**Assignment:**

* Create a process creation hierarchy as a dynamic array of length n which references the process control blocks (PCBs), indexed 0 to n-1
* Each PCB is a structure consisting of two fields:
  + parent: a PCB index corresponding to the process’ creator
  + children: a pointer to a linked list, where each node contains the PCB index of one child process and a link to the next child in the list
* The necessary functions are simplified as follows:
  + create() represents the create function, which prompts for the parent process PCB[p]. The function creates a new child process PCB[q] of process PCB[p] by performing the following tasks:
    - allocate a free PCB[q]
    - record the parent's index, p, in PCB[q]
    - initialize the list of children of PCB[q] as empty (NULL)
    - create a new link containing the child's index q and append the link to the linked list of PCB[p]
  + destroy() represents the destroy function, which prompts for the parent process PCB[p]. The function recursively destroys all descendent processes (child, grandchild, etc.) of process PCB[p] by performing the following tasks: for each element q on the linked list of children of PCB[p]:
    - destroy(q) /\* recursively destroy all descendants \*/
    - free PCB[q]
    - deallocate the element q from the linked list

**What NOT to do:**

* Do NOT modify the choice values (1,2,3,4) or input characters and then try to convert them to integers--the test script used for grading your assignment will not work correctly.
* Do NOT turn in an alternate version of the assignment downloaded from the Internet (coursehero, chegg, reddit, github, etc.) or submitted from you or another student from a previous semester—the test cases from this semester will not work on a previous semester’s assignment.

**What to turn in:**

* The source code as a file uploaded to Canvas by the deadline of 11:59pm PST
* As a note, even though your code may compile on a compiler you have installed on your computer, I do not have access to your computer. I will be using the following free online compiler for testing, so make sure your code compiles with the following online C compiler before submitting: <https://www.onlinegdb.com/online_c_compiler>

**Sample output**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 1**

**Enter maximum number of processes: 5**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 2**

**Enter the parent process index: 0**

**PCB[0] is the parent of: PCB[1]**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 2**

**Enter the parent process index: 0**

**PCB[0] is the parent of: PCB[1] PCB[2]**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 2**

**Enter the parent process index: 2**

**PCB[0] is the parent of: PCB[1] PCB[2]**

**PCB[2] is the parent of: PCB[3]**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 2**

**Enter the parent process index: 0**

**PCB[0] is the parent of: PCB[1] PCB[2] PCB[4]**

**PCB[2] is the parent of: PCB[3]**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 3**

**Enter the index of the process whose descendants are to be destroyed: 0**

**Process creation and destruction**

**--------------------------------**

**1) Enter parameters**

**2) Create a new child process**

**3) Destroy all descendants of a process**

**4) Quit program and free memory**

**Enter selection: 4**

**Quitting program...**