Mid Term Exam - Advanced Operating Systems
Fall 2020

Start Time: 9:15 am

Submission Time via email: 10:30 am

Total Marks: 40

Submission Instructions:

- The paper will be shared with the students on University Learning Management System
- Students need to answer the questions (**hand written**) on **A-4** sheets by mentioning their names and roll numbers on each paper
- After attempting the papers, students need to convert the solved answer sheets to a single pdf file using camscanner or any other tool
- Finally, email the single pdf file containing solutions to all the questions to Teaching Assistant email ID: mscsf19m015@pucit.edu.pk before the elapsed time
- No paper will be graded that is received after the elapsed time

Question # 1

a. Study the code given below and give a tick symbol in the table below mentioning the global, external and local symbols with reference to a linker [5]

f1.c

```
int ctr1;
int ctr3 = 554;
int main(){
   int i;
   int rv = foo(i);
   func3();
   return 0;
}
```

f2.c

```
static int ctr2 = 222;
extern int ctr3;
int foo(){
   int j;
   func3();
   …
   return j;
}

void func3(){
   static int a;
   …
}
```

Symbol name	Global symbol		External symbol		Local symbol	
	Strong	Weak	Strong	Weak	Strong	Weak
`ctr3` in `f1.c`						
`ctr1` in `f1.c`						
`func3` in `f1.c`						
`ctr3` in `f2.c`						
`ctr2` in `f2.c`						

b. Give the diagrammatic description of the structure of an allocated block and a free block on heap. Also describe how the heap memory is laid out as linked list of unallocated blocks. [5]

c. Give **shell command(s)** to create a static library named `libpucit.a` that should contain object code for the source files `f1.c` and `f2.c`. You have written a `driver.c` program which is using standard `math` library and the `libpucit` library (that you have just created). The driver program is also using a header file located in `/tmp/myheaders/progheader.h`. Assume that `libpucit.a` is located in the current working directory. Also give a **single shell command to** compile, link and create an executable

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of the `driver.c` program with the name of `myexe` by forcefully statically linking your program with all of the above-mentioned libraries. [5]

d. Suppose you have a C program whose structure is shown in the following table. You want to create the executable with the name of `myexe`. The program is using math library as well as `libpucit.a` library. Write down a `makefile` for this program. You should use all the targets that you have studied in class. [5]

Source Files	Include files
`main.c`	`file1.h, file2.h`
`one.c`	`file3.h`

e. Suppose two different processes have opened the same file using `open()` system call. Draw a diagram that describes the relationship between the file descriptor to the file blocks on disk. [5]

f. Write down a descriptive note on Traditional UNIX CPU Scheduler by drawing, labeling the queue diagram. Do describe the use of nice value to get full credit [5]

g. Define a zombie process. Why zombies are not good for a system. How can we avoid the creation of zombie processes? Write down a C program that will create a zombie process. [5]

h. Assume the mode of a file in octal is 0104711. Write the nine characters of the permissions that **`ls –l`** will display for this file. Describe your working to get full credit. [5]