IC221 System Programming
Spring 2016
HW15

NAME:_____

COLLABORATOR(S):_____

8/6/3/0 1. Match the following socket system calls to their description:

socket() ___	(a) A client routine to pair a socket to a remote host.
bind() ___	(b) A routine to associate the socket with a given local address
accept() ___	(c) Clean up a socket after all operations are complete
listen() ___	(d) Create a new socket
connect() ___	(e) Specify the socket as willing to accept incoming connections
close() ___	(f) Create a new socket for an incoming connection for futher communication

5/3/1/0 2. Explain why when accepting an incoming connection a *new* socket is created?

5/3/1/0 3. Explain the second argument to **listen()**, the **backlog.**

7/5/3/1/0 4. Below is an output of the hello_server program from the course notes, can you explain the change in ports from client to server?

```
#> ./hello_server
Listening On: 127.0.0.1:1845
Connection From: 127.0.0.1:42555
Read from client: hello
Sending: Hello 127.0.0.1:42555
Go Navy! Beat Army
Closing socket
```

___/25

NAME: _____

8/6/3/1/0

5. Consider the code loop for handling client sockets: Can this program handle multiple clients simultaneously? That is, if multiple clients are connected, will the server be able to services all sockets when data is available? Explain.

```
char buf[BUF_SIZE];
int sockets[NUMSOCKS], i,n;

//iterate over all open sockets
for(i=0;i < NUMSOCKS; i++){
    if(i>0){
        //read from socket
        n = read(sockets[i], buf, BUF_SIZE);

        //socket closed
        if(n<0){
            close(sockets[i]);
            sockets[i] = -1;
        }

        //echo back
        write(sockets[i], buf, n);
    }
}
```

5/3/1/0

6. What does a **select()** procedure do? And, how does **select()** and multi-threading avoid the problem above?

7. Match the programing unit to its description.

7/5/3/0

FD_ZERO() ____	(a) Check if a file descriptor in the fd_set is actionable, e.g., can be read/write from.
select() ____	(b) Type for storing select information for a set of file descriptors
fd_set ____	(c) Set a file descriptor to be tested as actionable by select()
FD_ISSET() ____	(d) Given a set of file descriptors, test if any are actionable
FD_SET() ____	(e) Remove a file descriptor from the testing set
FD_CLR() ____	(f) Completely clear the set of file descriptors

___/20

NAME: _____

8. For each of the statements, indicate if the statement is True or False. You must provide an additional brief statement in support of your selection:

(a) Threads are created just like processes by calling fork() except instead of checking the return value of fork() a specified function is executed.

5/3/1/0

TRUE / FALSE

(b) Threads are scheduled just like other processes because POSIX threads are treated like individual process by the OS.

5/3/1/0

TRUE / FALSE

(c) Like multiple processes, threads provide resource isolation. Two threads from the same program do not share memory or other resources.

5/3/1/0

TRUE / FALSE

9. What are the equivalent thread commands for system call **fork()** and **wait()**?

5/3/1/0

10. Match the identifier to its description:

10/8/6/3/0

tid ____	(a)	Retrieve the POSIX thread identifier for the calling thread
pid ____	(b)	The process identifier, shared by all threads of a multi-threaded program
pid_t ____	(c)	Retrieve the Unix OS thread identifier of the calling thread
pthread_t ____	(d)	Retrieve the Unix OS process identifier of the calling process
syscall (SYS_gettid); ____	(e)	The type of a POSIX thread identifier
getpid() ____	(f)	The type of the Unix OS thread identifier
pthread_self() ____	(g)	The thread identifier, unique to each thread and equal to the pid for the main thread

___/30

NAME: _____

10/8/6/3/0

11. Fill in the following program that prints the first command line argument from the thread. For each line of code you add, provide a brief comment describing the purpose/function:

```
void * startup( void * args){
    char * str; //varible to reference string to print



    printf(                                          );
    return NULL;
}

int main(int argc, char * argv[]){

    pthread_t thread; //POSIX thread identifier


    //create a thread to run startup with argument argv[1]
    pthread_create(&thread, NULL, startup, argv[1]);




    return 0;
}
```

12. Answer the following questions about the program to the left, assume the program was run on the lab machines:

```
#include <stdio.h>
#include <stdlib.h>
#include <pthread.h>


void * foo(void * args){
    pthread_t thread;

    if(args == NULL){
        pthread_create(&thread, NULL,
                       foo, (void *) 1);
    }

    while(1);
}

int main(int argc, char * argv[]){
    pthread_t threads[4];
    int i;

    for(i=0;i<4;i++){
        pthread_create(&threads[i], NULL,
                       foo, NULL);
    }

    while(1);
}
```

(a) Based on the code, what are the two possible values for the argument to foo()?

5/3/1/0

(b) When you run this program, how many threads are running. Use ps -L to count:

5/3/1/0

(c) According to top what percent CPU does the program consume? Is this more or less than you expect? Explain.

5/3/1/0

___/25