IC221 System Programming
Spring 2014
HW11

NAME:______________________

COLLABORATOR(S):______________________

8/5/2/0 1. Which of the socket system calls are server side and which are client side? Circle client socket calls and box server socket calls. Circle *and* box system calls used for both:

socket() connect() bind() accept() read()

write() close() listen()

5/3/2/0 2. Explain why for a server socket you do not read and write using that socket once an incoming connection is accepted?

5/3/2/0 3. The argument to the listen() system call is an integer number that requests the operating system to do what?

7/5/2/0 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
```

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10/8/5/2/0 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);
    }
}
```

7/5/2/0 6. What is the select() system call used for and how does it relate to blocking on read/write/accept for sockets and socket-servers?

8/5/2/0 7. Match the programing unit to its description.

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

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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.

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TRUE / FALSE

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

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TRUE / FALSE

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

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TRUE / FALSE

9. 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:

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```
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;
}
```

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10. 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()?

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

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

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11. Match the identifier to its description:

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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

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