These questions are intended to supplement past exams not replace them.

The final exam will have some small coding parts and a number of medium sized ones rather than a large exercise.

Shell

How many files are in the current directory?

For each user with processes running on the system print their name and how many processes are they running.

Show all lines in files f1, f2, f3 which contain the word “tiger”.

Show the second last line in a file.

Show all the lines in a file which do not contain “tiger”.

Show all vim processes running on moss.
[You might want to actually try this one]

Rename main.c to flip.c in svn repository.

List only files which have uncommitted modifications.

Declarations

Declare foo to be:
a long integer
an array of 12 short integers
a struct containing a pointer to an int
an array of strings
a union containing a string, an array of strings and a char

basic coding
You should be able to do any of the questions in this section in less than five minutes.

Implement the following functions:

- size_t strlen(const char* str)
- void strcpy(char* dest, const char* src)
- void strcat(char* dest, const char* src)

void replace(char* str, char f, char r)
- replace all occurances of f with r.

char* copyandremove(const char* src, char del)
- return a copy of src with all occurances of del removed.

void backwardscopy(char* dest, const char* src)
- dest is a copy of src but reversed

void substring(char* dest, const char* src, size_t start, size_t end)
- Copy the string of chars beginning at src[start] and ending at src[end]
- Check for illegal values for start and end

void uppercase(char* s)
- Change all letters(a-z) to upper case in string s

int frequent(int* arr, size_t len)
- Find the most frequently occuring positive value in arr (doesn't need to be efficient)

Find the second most frequently occuring value in arr. Assume the previous function exists and works correctly.

int sum(int* arr, size_t len)
- return the sum of all even values in arr

int **makeArray(size_t m, size_t b)
- Allocate and return an mxn array of its

void destroy(int** v, int m)
- deallocate a 2D [mx?] array pointed to by v

int* filter(int* arr, size_t size, int lim)
- create an array (no bigger than necessary) which contains all the values from arr which are < lim.

char** strarrcpy(const char**s, size_t size)
- Create a copy of the array of strings and return it. Do not use more memory than required. Do not

leak memory. [You may use functions from <string.h> for this one]

What is the danger with the following line:
scanf("%d %s", &i, mystr);

The following describes a binary tree [each node has up to two "children"]

```
struct Tree* {
   void* data;
   struct Tree* left;
   struct Tree* right;
};

struct Tree* create(void* d) {
   struct Tree* res=malloc(sizeof(struct Tree));
   res->data=d;
   res->left=0;
   res->right=0;
   return res;
}

void attachLeft(struct Tree* t, struct Tree* newt) {
   if (t->left==0) {
      t->left=newt;
   }
}
```

What input would cause attachLeft() to misbehave?

Write attachRight().

Write struct Tree* find(struct Tree* root, void* d)
- return the first node in the tree which stores data d. [There is some information missing which you need in order to answer this question – what is it?]

void destroy(struct Tree* root)
- Destroy the tree beginning at root.

size_t size(struct Tree* root)
- Count the number of nodes in the tree

For the list struct discussed in lectures write a function to compute the length of a list.

What is foo in the following:
char* const foo;
char X, *foo;

```
typedef int* foo;
int (*foo)(int, char)
const char* const * foo;
int** (*foo[10])();
int **(*foo)(int[]);
```

What is the value of x after the following:

```
int a=1;
int x=0;
while (a++-2<4) {
  x++;
}
```

```
int a=2;
int x=0;
switch (a+a/2*3) {
   case 5: x=1; break;
   case 6: x=2; break;
   default:
      x+=3;
}
```

```
for (int a=0,x=1; a<5; x+=a,  a++);
```

```
int a=0;
int b=1;
int x=2;
b+=x;
x=a++-1;
x-=a+b;
```

```
int a=7;
int x=5;
x=(x^a)&(x|a);
```

File systems:
Identify each column in the following output from ls -li
27814396 -rwx--x--x 1 uqjfenw1 uusers 11335 Apr 3 18:59 moss

Suppose you have a directory called *cats*.
What command would you need to use to allow user *joel* to list files in that directory?
What extra information would you need in order to answer this question?

What permissions are required to execute a shell script? Why?

-r---w---x 1 uqjfenw1 uusers 11335 Apr 3 18:59 moss
If uusers consists of richard, luke, tom and pat what can the following users do to moss?
richard,
uqjfenw1
peter

What type of files are the following:

1. virtual-jfenwick.PBe8Ew
2. magic
3. mov01256.mpg
4. virtual-jfenwick.PBe8Ew
5. mayavi_user_guide.pdf

What is the maximum possible size for a "unix" file system which has i-nodes with 10 direct pointers, 2 indirect pointers and 2 double indirect pointers [blocks are 4KB and each block can store 512 pointers]?

For the above filesystem how many blocks must be read to access the following bytes of the file:

1. 200,
2. 4096,
3. 40959,
4. 40960
5. 4235901

Are there any circumstances when a linked filesystem would perform better than a "unix" filesystem? Explain.

What are two differences between symlinks and hardlinks.

Networks:

What are the network addresses of the following hosts:

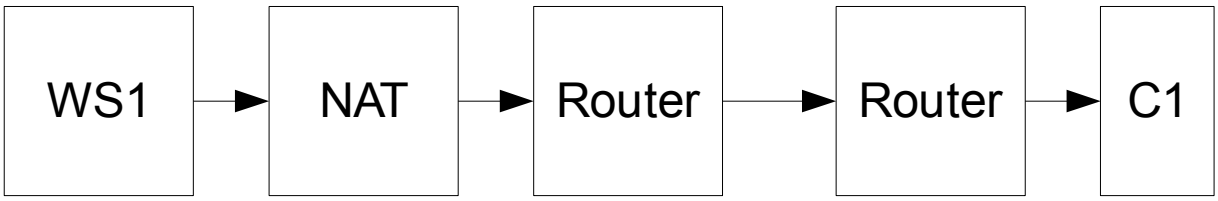
Address	netmask
130.102.65.27	255.224.0.0
130.102.65.27	255.255.240.0
78.78.78.78	128.0.0.0
69.163.249.38	255.255.255.0

What are the layers of the IP stack and what are their purposes?

Which layers are responsible for:

1. ensuring a message has not been damaged
2. ensuring that messages arrive
3. transferring data
4. communicating between hosts
5. communicating between adjacent hosts
6. communicating between processes
7. communicating between processes on adjacent hosts

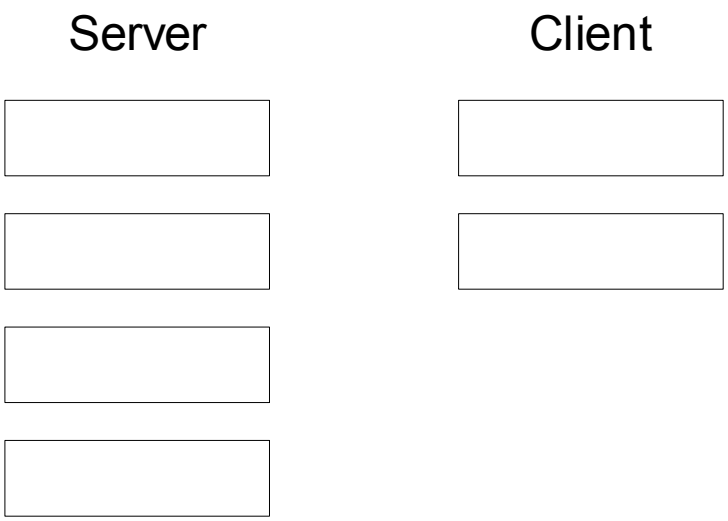
Which layers are involved [and what do they "send"] in each of the devices transferring data from a webserver(WS1) to browser running on client(C1).



What network queries (may) need to be executed to transfer the webpage above?

What is the purpose of a gateway on a network?

Fill in the sequence of calls needed to use TCP from the following words (duplicates allowed)
accept, socket, bind, connect, listen



For each address, give a netmask for which the address is a valid host address and a netmask for which it is not a valid host address:

```
114.78.128.0
192.168.0.40
10.0.14.20
```

Give the broadcast address for the networks which the following hosts belong to:

```
10.0.0.1       mask=255.255.255.0
10.0.0.1       mask=255.255.0.0
192.168.0.102  mask=255.254.0.0
```

Threads and processes:

In order to create a pipe linking two processes what constraints are there on those processes?

Who can join() a thread?

Who can reap a process?

Which function is used to reap?

Write a C fragment to execute a program *grabber.*

Why is the WEXITSTATUS macro required? That is why does wait not just send back the exit status of the child?

What is the difference between execv and execlp?