JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

COMPUTER SCIENCE

INTRODUCTION TO SYSTEMS PROGRAMMING

TIME: 2hrs

Q1

a) Explain why C language is usually referred to as the language of the system programmer (2mks)

b) Explain using two examples the 2 steps of using libraries in UNIX (4mks)

c) Differentiate the use of the following commands in the GNU debugger using suitable examples scenarios(4mks)
- Next and step
- Display and print

d) Discuss the POSIX standards , clearly outlining their effects on portability of developed applications (5mks)

e) Briefly explain any two families of system calls. Give an example of each (4mks)

f) Write UNIX sequence commands to complete, link and run a program saved as ‘hello.c’ . Explain each line (3mks)

g) Write UNIX command to change the permissions of a file named ‘myfile’ . The owner should have all permissions , the group, read and write permissions and the others read only permissions. Explain your command (4mks)

h) Write the full function declaration for main() and describe how it is used in making a program aware of its command line arguments(4mks)

Q2

a) Using a suitable diagrammatic example, describe UNIX file structure(2mks)

b) Explain any four types of file used in UNIX (8mks)

c) Write out the file contents for out.txt as produced by the following code. Give specific byte values. How many total bites will the file contain in the end of the execution?(3mks)

```
#include <stdio.h>
main()
{
FILE *fpt ;
Int x;
fpt=fopen(“out.txt”, “w”);
for (x=0 ; x<15;x+=2)
fprintf(fpt, “2%d” , x);
fclose(fpt);
}
```

d) Using examples briefly explain the following UNIX commands (4mks)

- chown
- mv
- more
- ls-al

e) char d[8];

```
printf(“%s/n” , d[0]);
```

The above printf statement will cause the program to crash. Explain why and rewrite correctly (3mks)

Q3

a) Give the output of the following code. Explain each output (6mks)

```
char a;
unsigned char b;
a= ‘A’ ;
b= ‘B’ ;
printf(“%c %c %d %d/n” , a, b, a, b);
a=183;
```

```
b= 255;
printf("%d %d/n" , a, b);
```

b) Using floating point bit model write -5 in bits(4mks)

c) Write a function that counts bits set 1 in an 8 bitnumber (unsigned char) passed as an argument to the function. Using comments explain how the relevant lines work at the bit level (6mks)

d) Write a memory map for the following code. Show all values at the end of the execution of the program.(4mks)

```
#include <stdio.h>
main()
{
int x[2][3][2];
int i, j , k;
for(i=0; i<3; i++)
for(i=0; i<2; i++)
x[0][i][j]= i*3+j;
for(k=0; k<2; k++)
for(j=0; j<3; j++)
x[1][k][j]= x[0][j][k] -1;
}
```

Q4

a) The following program demonstrates how processes are created. Study and answer the questions

```
#include<stdio.h>
#include<unistd.h>
main()
{
int j, i;
j=0;
printf("ready to fork…\n");
i=fork();
if(i==0)
{
printf(“the child executes this code \n”);
for(i=0;i<5;i++)
j=j+5;
printf(“child j=%d\n” , j);
}
else
{
printf(“the parent executes this code \n”);
for(i=0;i<3;i++)
j=j+i;
printf(“ parent j=%d \n”, j); }}
```

Describe its output , pointing out the fork system call is called once but returns twice(4mks)

b) Give an advantage of libraries over system calls (1mks)

c) Using examples explain the difference between Singly and Doubly linked lists (6mks)

d) What is dynamic memory allocation (2mks)

e) Give two scenarios where it would be necessary to use dynamic memory allocation (2mks)

f) Explain in details the following piece of code add code to free the memory
int *ip;
ip=(int*)malloc(100*sizeof(int)); (5mks)