Indian Institute of Technology Guwahati
Computer Science & Engineering
CS 101: Fundamentals of Computing

No of Questions: 9 *Maximum Time: 3 Hours*
Maximum Marks: 65

1. [4 Marks] Show the macro expansion. What is the output of the following program segment?

```
#define xyz(A, B)   ((A--) > (B--) ? (A--) : (B--))
main(){
    int i=3, j=5, k;
    k = xyz(i,j);
    printf("%d %d %d\n", i, j, k);
}
```

Ans:
Expanded Macro: `k = ((i--) > (j--) ? (i--) : (j--));` 1 mark
Output of the program: `2 3 4` 1 + 1 + 1 Marks

2. [4 Marks] What is the output of the following program segment?

```
#define cube(x)   x*x*x
main(){
    int i=5;
    printf("%d %d\n", cube(i), cube(i+1));
}
```

Ans:
Output of the program: `125 16` 1 + 3 Marks

3. [4 Marks] What is the output of the following program segment?

```
#include<stdio.h>
main()
{
   enum months  { JAN = 2 , FEB = 4, MAR, APR = 8, MAY = 10, JUN,
                  JUL = 14, AUG, SEP = 18, OCT = 20, NOV = 22, DEC};
   enum months m = MAR;
   switch (m) {
       case 2: printf("%d\n", JAN);
               break;
       case 4: printf("%d\n", FEB);
               break;
       case 6: printf("%d\n", MAR);
               break;
       default : printf("Illegal data.\n");
   }
}
```

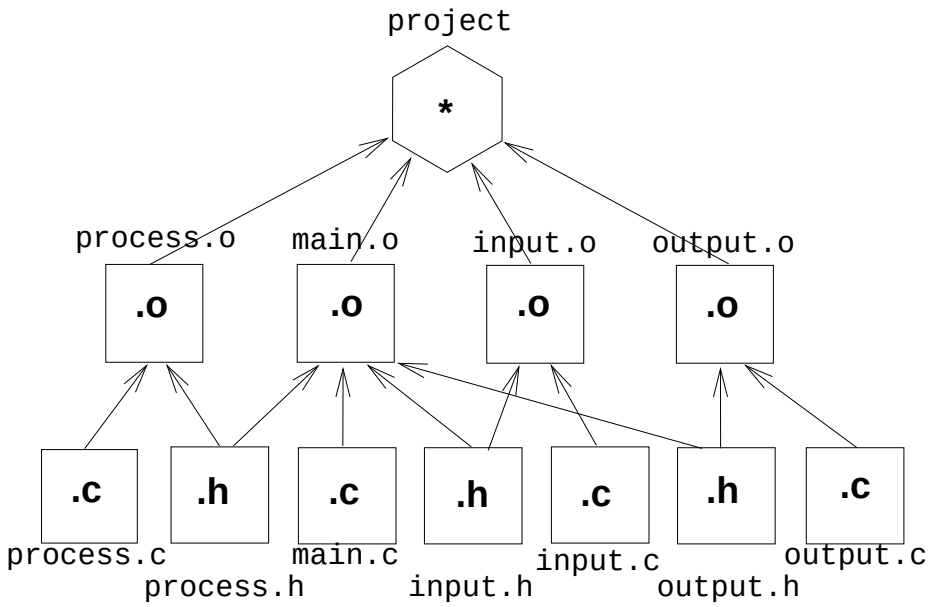
Ans:
Output of the program: `Illegal data.` 4 Marks

4. [4 Marks] What is the output of the following program segment?

```
#include<stdio.h>
main(){
    int x[][3][5]={
                    {{1,2,3,4,5,}, {6,7,8,9,10}, {11,12,13,14,15}},
                    {{16,17,18,19,20}, {21,22,23,24,25}, {26,27,28,29,30}},
                    {{31,32,33,34,35}, {36,37,38,39,40}, {41,42,43,44,45}},
                };
    printf("%d\n",(*(x+1))[2][3]);
}
```

Ans:
Output of the program: 29 4 Marks

5. [8 Marks] Write a simple make file for a program whose dependency graph is given below.



Ans:

```
project:  process.o main.o input.o output.o                    2 Marks
          gcc -o project process.o main.o input.o output.o
process.o:  process.c process.h                              1.5 Marks
          gcc -c process.c
main.o:  main.c process.h input.h output.h                   1.5 Marks
          gcc -c main.c
input.o:  input.c input.h                                    1.5 Marks
          gcc -c input.c
output.o:  output.c output.h                                 1.5 Marks
          gcc -c output.c
```

6. [10 Marks] Write appropriate comments C1, C2, C3, and C4 for the following program.

```
/* C1 */
#include<stdio.h>
main(int argc, char *argv[]){
```

```
    int i;
    char c;
    FILE *ifp, *ofp;
    if (argc<3) { /* C2 */
           printf("Illegal data.\n");
           exit(1);
    }
    ofp = (FILE *) fopen(argv[1], "w");
    for(i=2; i<argc; ++i){ /* C3 */
        ifp = (FILE *) fopen(argv[i],"r");
        if (ifp == NULL) continue; /* C4 */
        while((c=fgetc(ifp))!=EOF)fputc(c, ofp);
        fclose(ifp);
    }
    fclose(ofp);
}
```

Ans:

C1 This program takes a sequence, file1 file2 file3 ....., of file names as a command line arguments. Concatenation of files file2 file3 ..... is kept in file1. Skip files which are not present. 4 Marks

C2 If number of files names given in command line is one or zero then program terminates. 2 Marks

C3 For each file in the sequence, file2 file3 ....., processes. 2 Marks

C4 If file is not present then goto next file. 2 Marks

7. [8 Marks] What is the output of the following program.

```
#include<stdio.h>
int funf(int), fung(int);
main(){
     int x=5, y=10, i;
     for(i=1; i<=2; ++i){
          y += funf(x) + fung(x);
          printf("%d\n",y);
     }
}
funf(int x){
     int y;
     y = fung(x);
     return(y);
}
fung(int x){
     static int y = 10;
     y += 1;
     return(y+x);
}
```

Ans:
Output of the program: `43 80` 4 + 4 Marks

Output, if variable `y` in function `fung` is simple local variable: `42 74` 2 + 2 Marks

8. [10 Marks] Write appropriate comments C1, C2, C3, and C4 for the following program.

```
/* C1 */
#include<stdio.h>
#define aaa(x) (('A'<=x)&&(x<='Z'))?(x-'A'+'a'):x /* C2 */
#define bbb(x) (('a'<=x)&&(x<='z'))?(x-'a'+'A'):x
void xxx(char *), yyy(char *), zzz( void *(char *), char *);
main(int argc, char *argv[]){
     if (argc!=3) {
          printf("Illegal data.\n");
          exit(1);
     }
     zzz(((argv[1][0] - '0') ? xxx : yyy), argv[2]); /* C3 */
     printf("%s\n",argv[2]);
}
void xxx(char *c){
     while(*c = aaa(*c))c++;
}
void yyy(char *c){ /* C4 */
     while(*c = bbb(*c))c++;
}
void zzz( void *fun (), char *c){
     fun(c);
}
```

Ans:

C1 This program takes two arguments as a command line arguments. If first argument is 0 then converts all alphabets in the second argument into upper case. Otherwise, converts into lower case string. 4 Marks

C2 Macro `aaa` converts an upper case alphabet into lower case. Macro `bbb` converts a lower case alphabet into upper case. 2 Marks

C3 function `yyy` is passed as an argument, if first command line argument is 0, otherwise `xxx` is passed. 2 Marks

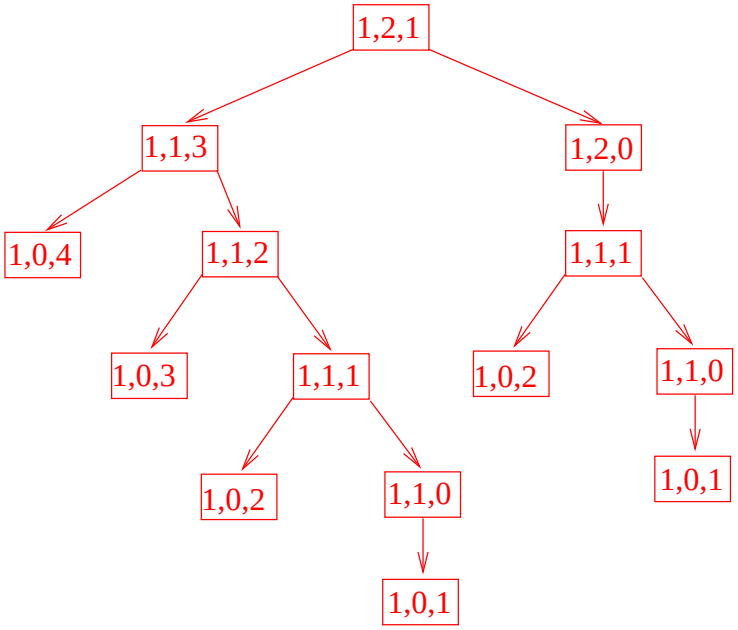
C4 Converts all lower case characters in given string into upper case. 2 Marks

9. [13 Marks] What is the return value of the function `abc(1,2,1)`. Show the recursive function calls in the form of a tree. Give the sequence of function calls.

```
int abc(int i, int j, int k){
   if(j==0) return(k+i);
   if(k==0) return (abc(i,j-1,1));
   return (abc(i, j-1, abc(i,j, k-1)));
}
```

Ans:
Output of abc(1,2,1) = 5 3 Marks

Function call in the form of Tree: 5 Marks



Sequence of function calls: abc(1,2,1), abc(1,2,0), abc(1,1,1), abc(1,1,0), abc(1,0,1), abc(1,0,2), abc(1,1,3), abc(1,1,2), abc(1,1,1), abc(1,1,0), abc(1,0,1), abc(1,0,2), abc(1,0,3), abc(1,0,4). 5 Marks