Name:

Roll No: e.g. 170001 | **Dept.**: e.g. CHE | **Sect.**: e.g. A4

IIT Kanpur
ESC101 Fundam. of Comp.
Major Quiz 2B
Date: March 28, 2018

Instructions:

Total: **45 marks**

1. This question paper contains a total of 6 pages (6 sides of paper). Please verify.
2. Write your name, roll number, department, section on **every side of every sheet** of this booklet
3. Write final answers **neatly with a pen** in the given boxes.
4. Do not give derivations/elaborate steps unless the question specifically asks you to provide these.

Problem 1 (Chase the Array!: 6 + 9 = 15 marks**).** Give your answers in the space provided only.

1. In the space given, write down the output of the program given below.

```
1  #include <stdio.h>
2  #define P 7
3
4  int fact[P];
5  int main() {
6    fact[0] = 1;
7    for (int i = 1; i < P; ++i)
8      fact[i] = i;
9
10   for (int i = 1; i < P; ++i)
11     fact[i] = i * fact[fact[i-1]%P];
12
13   for (int i = 1; i < P; i++)
14     printf("%d\n", fact[i]);
15
16   return 0;
17 }
```

```
1  1
2  2
3  6
4  24
5  30
6  12
```

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2. In the space given, write down the output of the program given below.

```
1  #include <stdio.h>
2
3  int A[16][16];
4  int counter;
5  void recurse1(int i, int j, int size);
6  void recurse0(int i, int j , int size) {
7    if(size <= 1) {
8      A[i][j] = 0;
9      return;
10   }
11   recurse1(i,j, size/2);
12   recurse0(i + size/2,j, size/2);
13   recurse1(i,j + size/2, size/2);
14   recurse1(i + size/2,j + size/2, size/2);
15   counter += 3;
16 }
17 void recurse1(int i, int j, int size) {
18   if(size <= 1) {
19     A[i][j] = 1;
20     return;
21   }
22   recurse0(i,j, size/2);
23   recurse1(i + size/2,j, size/2);
24   recurse0(i,j + size/2, size/2);
25   recurse0(i + size/2,j + size/2, size/2);
26   counter += 3;
27 }
28 int main() {
29   counter  = 0;
30   recurse1(0,0,4);
31   printf("%d\n",counter );
32   for(int i = 0; i < 4; i++) {
33     for(int j = 0; j < 4; j++)
34       printf("%d",A[i][j]);
35     printf("\n");
36   }
37   return 0;
38 }
```

```
1  15
2  1111
3  0101
4  0011
5  1001
```

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Problem 2 (Strings Boomerang!: 2 + 3 + 4 + 6= 15 marks). Give your answers in the space provided only.

1. What is the memory allocated to the string Str if **Str[] = "Alpha11"**. Assume that **sizeof(char) = 1**.

8

2. In the space given, write down the output of the program given below.

```
1  #include <stdio.h>
2  #include <string.h>
3
4  void main() {
5      char str[10];
6      char *s = "Tuesday";
7      int length = strlen(s);
8      int i;
9      for (i=0; i<length; i++)
10         str[i] = s[length - i];
11     printf("Sun %s\n",str);
12 }
```

```
1  Sun
```

3. In the space given, write down the output of the program given below.

```
1  #include <stdio.h>
2
3  void main(){
4      char str[] = "It's a great day!";
5      printf("%c\n",*str);
6      printf("%s\n",str);
7      str[10] = '\0';
8      printf("%s\n",str);
9  }
```

```
1  I
2  It's a great day!
3  It's a gre
```

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4. In the space given, write down the output of the program given below.

```
1  #include <stdio.h>
2
3  void main(){
4      int i, j, k;
5      char str[8] = "!teewS";
6      char str2[8];
7
8      for(i = 0; str[i] != '\0'; i++);{
9      printf("Loop?\n"); }
10
11     int length = i;
12     printf("length = %d\n", length);
13
14     for(j = 0, k = i-1; j<i; j++, k--)
15         str2[j] = str[k];
16     str2[j] = '\0';
17
18     printf("%s", str2);
19 }
```

```
1 Loop?
2 length = 6
3 Sweet!
```

Problem 3 (Porcupine Tree Revival: 5 + 4 + 6 = 15 marks). Porcupine Tree is my favourite band but unfortunately, they stopped their live performances few years ago. Yesterday, I had a dream that Steven Wilson (who formed the band in 1987) reunited all its members and decided to give live performances in 3 regions - New York, London and Paris. They have figured out the top 3 popular songs in each region and stored it in the form of a 3 X 3 2D array of pointers to strings:

```
1 char *songs[3][3] = {
2     {"Trains","Blackest Eyes","Drown With Me"},
3     {"Anesthetize","Way Out Of Here","Half Light"},
4     {"Fear Of A Blank Planet","Open Car","Lazarus"} };
```

Now they need someone experienced in pointer operations to manage this matrix of songs. So they have provided 3 questions and the fastest correct answerer will get the job. Please help me get shortlisted!

1. ***Can you tell the output of the following printf statements?***

```
1 printf("1 : %s\n", (**songs+1));
2 printf("2 : %s\n", **(songs+2));
3 printf("3 : %s\n", *(*songs+1));
4 printf("4 : %s\n", *(*songs+2)+2);
5 printf("5 : %s\n", *(*(songs+1)+1)+2);
```

```
1 1 : rains
2 2 : Fear Of A Blank Planet
3 3 : Blackest Eyes
4 4 : own With Me
5 5 : y Out Of Here
```

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2. ***What will be the output for this?***

```
1 int *a = songs[0][0];
2 char str[] = {a[0],a[3],a[1],a[5],a[7],a[2]};
3 printf("%s\n", str);
```

```
1 Ten
```

3. ***They want to replace one of the songs in playlist with the song "Shallow". Write the output of these three printf statements to determine which function/functions actually serve the purpose. In case of any garbage value, write* GARBAGE *for that printf statement.***

```
1  #include <stdio.h>
2
3  char* foo()
4  {
5      char str[] = "Shallow";
6      return str;
7  }
8
9  void bar(char *songs[3][3])
10 {
11     char str[] = "Shallow";
12     songs[1][0] = str;
13     return;
14 }
15
16 void fun(char *songs[3][3])
17 {
18     songs[1][0] = "Shallow";
19     return;
20 }
21
22 int main()
23 {
24   // Initialisation of 2D array of
      pointers to strings
25   // char *songs[3][3] = {
26   // ...
27   songs[1][0] = foo();
28   printf("%s\n", songs[1][0]);
29   bar(songs);
30   printf("%s\n", songs[1][0]);
31   fun(songs);
32   printf("%s\n", songs[1][0]);
33   return 0;
34 }
```

```
1 GARBAGE
2 GARBAGE
3 Shallow
```

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