Indian Institute of Information Technology Sri City, Chittoor

(An Institute of National Importance under An Act of Parliament)

Name: **Computer Programming Lab** Total: **20 Marks**

Date and Time of the Exam: **March 18, 2021 starts at 02:00 PM** Duration: **90 Mins**

Instructions: Code: **cplabex**

1) Read all questions carefully and answer both questions in the same c file.
2) Create a .c file with the following file name convention (Use hyphen and not underscore):

   XYZK-cplabex-AYCOY.c

   Where
   XYZK represents the last 4 digits of your roll number
   cplabex is the Lab Exam code
   AYCOY - this can be any 5 English Alphabets in **CAPITAL** letters - Do not choose any numbers or special symbols (this is your secret key and do not share with others).
3) Strictly follow the file name convention and do not use scanf()
4) For Submission Instructions, Please follow announcements during the exam

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1) **[10 Marks]** Assume (Initialize) the following 10 x 10 matrix:

7	**2**	5	2	8	2	3	4	2	5
8	**18**	**3**	10	18	1	14	32	5	2
8	**5**	6	3	9	1	5	9	2	1
9	20	46	7	5	11	2	8	18	3
46	82	13	10	4	3	13	3	5	4
3	33	4	18	40	7	5	9	23	2
5	6	16	1	11	17	39	6	7	3
16	38	5	11	2	4	11	2	3	1
7	11	2	4	10	1	4	9	1	2
6	6	5	1	3	5	4	3	2	4

In the above matrix, consider each 3 x 3 matrix that has the following pattern of values (two such patterns are highlighted in the above matrix with block border):

7	**2**	5
8	**18**	**3**
8	**5**	6

Here the centered element (whose value is 18) is surrounded by 4 values at the top, right, bottom and left (clockwise) as described below:

Top: This value must be an even number (2 in the above case)
Right: This value must be an odd number (3 in the above case)
Bottom = sum of top and right values (2 + 3 = 5)
Left = sum of right and bottom values (3 + 5 = 8)
Center = sum of top, right, bottom, & left values (2+3+5+8=18)

Now write different functions to do the following tasks:

a) Write a function to check whether k is an even number or not? It may return 0, if the given number is even and 1, otherwise

```
int isEven(int k);
```

b) Write a function to check whether k is an odd number or not? It may return 1, if the given number is odd and 0, otherwise

```
int isOdd(int k);
```

c) Write the following function to Identify all 3x3 matrices that satisfy the above pattern and print all such 3 x 3 matrices:

```
int findandprint(int *arr, int m, int n);
```

This function returns the sum of top, right, bottom and left values (The above two functions can be used in this function. You may write additional functions as necessary)

2) **[Marks = 10 (= 4 + 2 + 2 + 2)]** Use dynamic memory allocation with pointers and arrays (Do not use linked list)
Define a CIRCLE using typedef with center, radius and area.
Write functions for the following tasks (Prototypes are given - Do not change these prototypes):

a) Write a function to create n circles (using dynamic memory allocation) by randomly generating a center (x, y) in [8.0, 8.0] and [20.0, 20.0] and radius in [2.0, 6.0]. Use srand() function with time to initialize the random number generator.

```
CIRCLE *genCircles(int n);
```

b) Write a function to find and print the area of each of n circles

```
void findArea(CIRCLE *c, int n);
```

c) Write a recursive function to print center, radius & area of each circle

```
void printCircles(CIRCLE *c, int n);
```

d) Write a function to find the count of the overlapping CIRCLEs among the given n circles and return the count (simply it in main() function)

```
int findOverlapCounts(CIRCLE *c, int n);
```