Shiv Nadar IoE, Delhi NCR

CSD101: Endsem exam

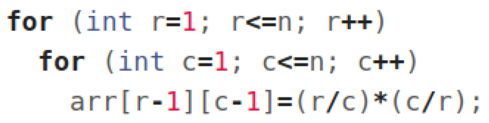
Monsoon 2022 semester

FM 45, Time 90 minutes

Roll number: ____________________ Name:____

- **Answer all questions in blue/ black pen only**
- **Write your answers at the places provided after each question**
- **WRITE YOUR ROLL NUMBER AND NAME AT THE SPACES PROVIDED ABOVE FAILING WHICH THE ANSWER SHEET WILL NOT BE CHECKED**

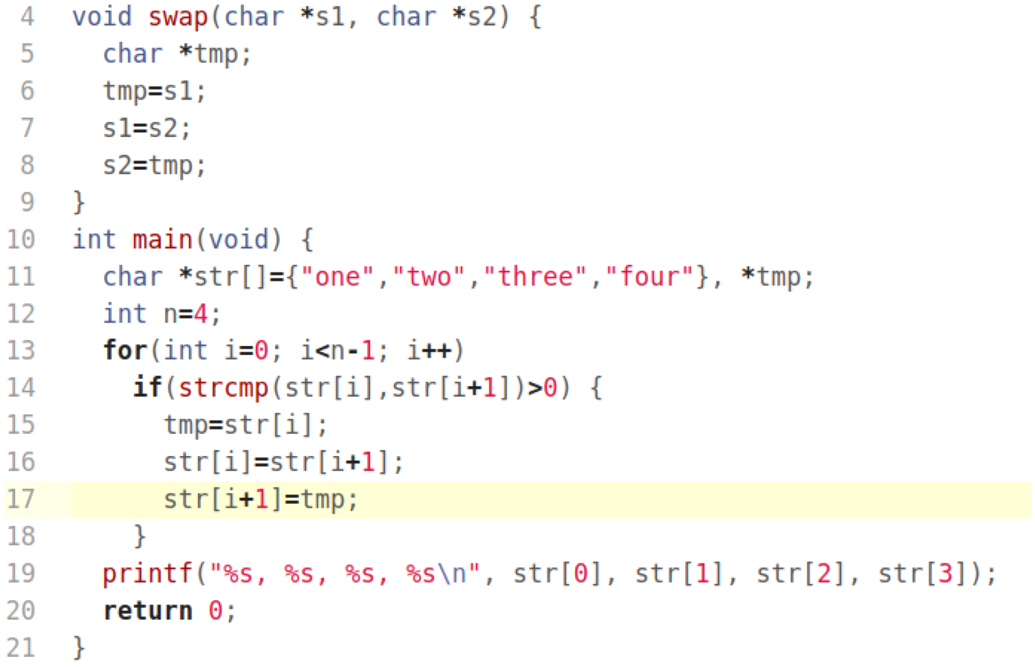
Q1. Study the code fragment below. Assume that a) arr is a 2-dimensional float array b) n is an integer initialized to a positive value greater than 1 and c) suitable declarations have been made. What is the code fragment doing? Give a precise and complete one line answer. [3]



```
for (int r=1; r<=n; r++)
  for (int c=1; c<=n; c++)
    arr[r-1][c-1]=(r/c)*(c/r);
```

Ans: It is initializing an n x n floating point identity matrix (or array). [3 marks]
[2 marks if dimensions n x n not specified]
[No deductions if other ways of describing identity matrix are correct.]

Q2. Carefully study the code fragment given below and answer the following questions. Assume the fragment is a part of a program that compiles.



```
 4  void swap(char *s1, char *s2) {
 5    char *tmp;
 6    tmp=s1;
 7    s1=s2;
 8    s2=tmp;
 9  }
10  int main(void) {
11    char *str[]={"one","two","three","four"}, *tmp;
12    int n=4;
13    for(int i=0; i<n-1; i++)
14      if(strcmp(str[i],str[i+1])>0) {
15        tmp=str[i];
16        str[i]=str[i+1];
17        str[i+1]=tmp;
18      }
19    printf("%s, %s, %s, %s\n", str[0], str[1], str[2], str[3]);
20    return 0;
21  }
```

a. What will be the output when the program is executed? [2 marks, no partial credit]

b. What will be the output if we replace lines 15 to 17 by the line

swap(str[i], str[i+1]);

and execute the program? [2 marks, No partial credit]

c. Justify your answers for a and b. [1+1 credit]

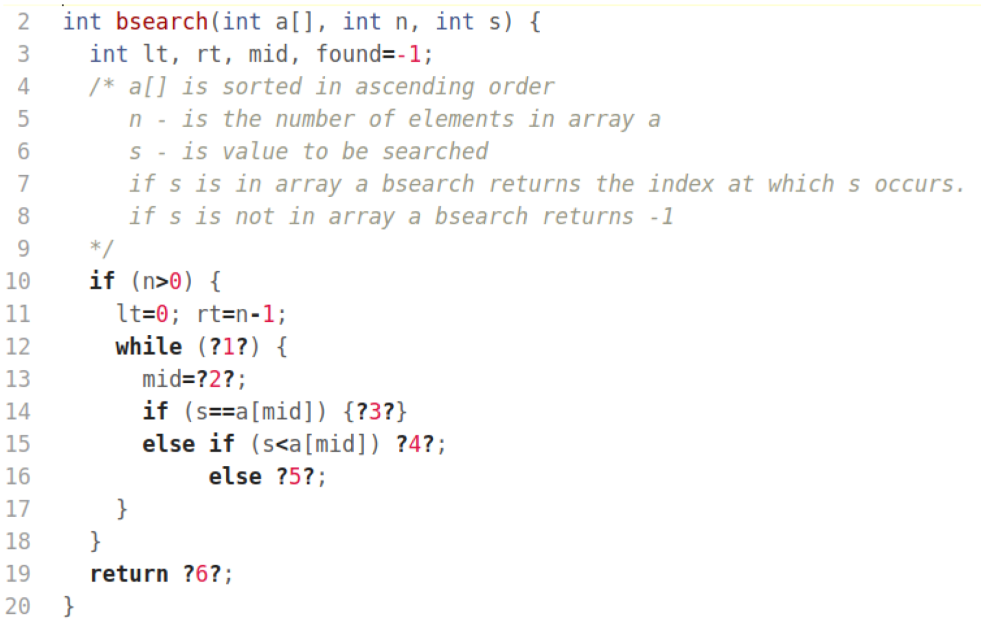
Ans: a. one, three, four, two

b. one, two, three, four

c. Due to call by value parameter passing copies of the pointers are passed to swap. These pointer copies are exchanged in swap but the contents pointed to are not exchanged so swap does not change the contents of the array. The original pointers in the calling function remain unchanged.

Q3. The function bsearch (code given below) searches for the value s in the array a that is sorted in ascending order. If s occurs in the array a it returns its index if it does not then it returns -1. In each iteration of the while loop bsearch eliminates half the remaining elements in the array from consideration depending on whether s is greater than or less than the middle element of those elements that remain.
For example, if a[1,2,4,7,10] and s=7 then we first compare with 4 and this reduces the array by half since the upper half is eliminated. Whenever, s is equal to the middle element then we know s occurs in the array and we can return the corresponding index.

a. The function bsearch below implements the above algorithm. Fill in the missing parts indicated by ?1? to ?6? so that the algorithm works correctly. ?3? is two statements. All other missing code is either a single expression or statement. The function can have just one return statement that is shown in line 19. [2+2+4+2+2+2]



```
2   int bsearch(int a[], int n, int s) {
3     int lt, rt, mid, found=-1;
4     /* a[] is sorted in ascending order
5        n - is the number of elements in array a
6        s - is value to be searched
7        if s is in array a bsearch returns the index at which s occurs.
8        if s is not in array a bsearch returns -1
9     */
10    if (n>0) {
11      lt=0; rt=n-1;
12      while (?1?) {
13        mid=?2?;
14        if (s==a[mid]) {?3?}
15        else if (s<a[mid]) ?4?;
16             else ?5?;
17      }
18    }
19    return ?6?;
20  }
```

b. If there are 1024 elements in the array and the search value s is not present in the array what is the exact number of comparion operations in which s is involved? Give a brief justification for your answer. [1+2]

Ans: (a)
?1? = lt<=rt [2 marks]
?2? = (lt+rt)/2 [2 marks]
?3? = found=mid; break; [4 marks]
?4? = rt=mid-1; [2 marks]
?5? = lt=mid+1; [2 marks]
?6? = found [2 marks]

Ans: (b) 22 comparisons.
If the array has only 1 element we have 2 comparisons, when it has 2 elements we have 4 comparisons
etc. More generally, when the array has 2^m elements we have 2(m + 1) comparisons. 1024 = 2^{10} so we have 22 comparisons.

Q4. Check if the following two code segments are valid to dynamically allocate memory to an array with m-rows and n-columns [2+2]

(i)
```
int **a, i, m, n;

 scanf("%d%d", &m,&n);

a = (int **) malloc (m * sizeof(int *));

for(i =0; i <m; i++)

  a[i] = (int *) malloc (n * sizeof(int));
```

(ii)
```
int *a, i, m, n;

 scanf("%d%d", &m,&n);

 a = (int *) malloc (m *n* sizeof(int ));
```

Ans: Yes for both

Q7. For the following code segment

```
struct

  {

    int x, y;

  } s[] = {10, 20, 15, 25, 8, 75, 6, 2};

 int *i;
```

```
    i = s;
```

What are the values: [1*4]

i. *(i+3),
ii. s[i[7]].x,
iii. i[s[3].y],
iv. s[i[0]-i[4]].y+10

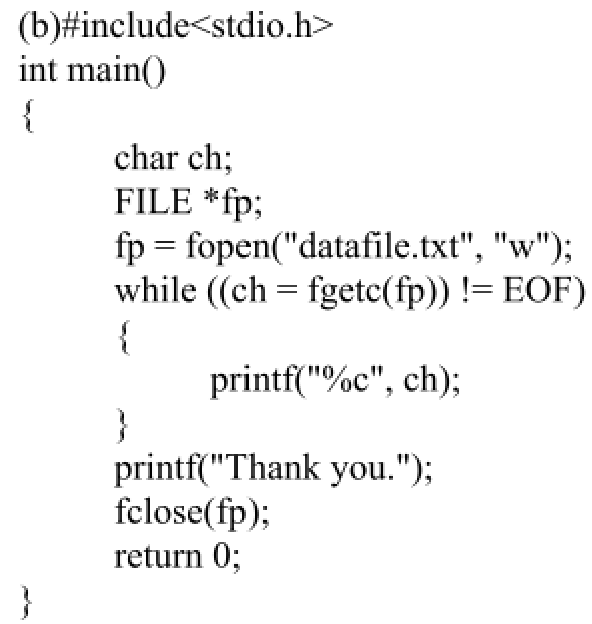
Ans. i. 25, ii. 8, iii. 15, iv. 85

Q8. What is the output of the following C code? [2*2]

/*The following programs use the datafile.txt which contains the following data*/

/* Hai. This is 2braces.com. */

```
(a) #include<stdio.h>
    int main()
    {
            unsigned char ch;
            FILE *fp;
            fp = fopen("datafile.txt", "r");
            while ((ch = fgetc(fp)) != EOF)
            {
                    printf("%c", ch);
            }
            printf(" Thank you.");
            fclose(fp);
            return 0;
    }
```



```
(b)#include<stdio.h>
int main()
{
        char ch;
        FILE *fp;
        fp = fopen("datafile.txt", "w");
        while ((ch = fgetc(fp)) != EOF)
        {
                printf("%c", ch);
        }
        printf("Thank you.");
        fclose(fp);
        return 0;
}
```

Ans: (a) "Hai. This is 2braces.com." and loop continues for infinite times.
(b) Thank you.

Q9. Explain the following notation if num[8] is an integer array: [3*1 = 3]

(a) num[i]
(b) *(num + i)
(c) num+2

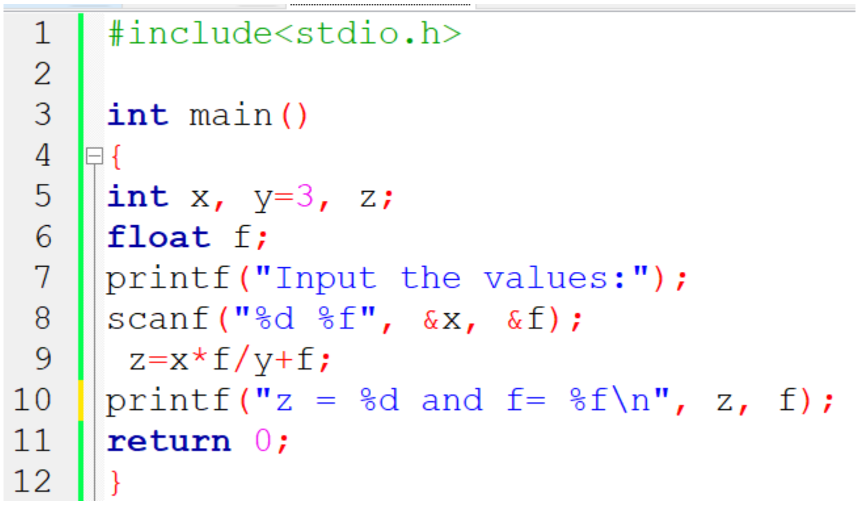
Ans: (a) i-th element of the array, num.
(b) i-th element of the array, num.
(c) Memory address of the 3rd element of the array, num.

Q10. True/False: [4 * 0.5 = 2]

a) Macros with arguments are not allowed.
b) To return the control back to the calling function we must use the keyword return.
c) The value of an automatic storage class variable persists between various function invocations.
d) All macro substitutions in a program are done after compilation.

Ans: F, F, F, F

Q11. Study the code and choose the correct answer when the input to the program is:12.2

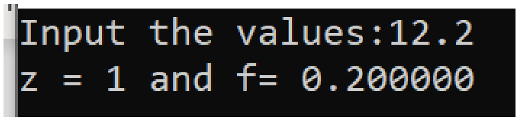


```
#include<stdio.h>

int main()
{
int x, y=3, z;
float f;
printf("Input the values:");
scanf("%d %f", &x, &f);
 z=x*f/y+f;
printf("z = %d and f= %f\n", z, f);
return 0;
}
```

[1+1]

Ans:



```
Input the values:12.2
z = 1 and f= 0.200000
```