

Fundamentals of Computing and Programming

Mid Term Examination. Maximum score 40, Total marks 43. Time Limit 2 hrs.

September 21, 2023

1. Answer each of these briefly as instructed: [4x2=8]

(a) What does the following print:

```
printf("%d %c", 'e' - 'a', 'a'+ 4);  
// prints an integer and a character
```

Explain your answer in one sentence.

(b) Draw a picture and show using arrow for pointer the relationship between the array `a[]` and the variables `p` and `q` after the last statement:

```
int a[10]={0,1,2,3,4};  
int *p, *q; // p and q are integer pointers  
p = &a[3];  
q = p-3;
```

(c) What does the following code print:

```
char name[20]="praggnananda";  
printf("%s",name+6);
```

(d) What does the following code print:

```
char name[20]="praggnananda";  
scanf("%s",name+6); // assume the input was "chess"  
printf("%s",name);
```

2. **Downify**

The code below converts given upper case character value to lower case and returns the converted lower case character: [5]

```
char downify(char a){  
    if ( __C__ ) { // check: if a is an upper case character  
                    // then compute the lower case character  
        __S__      // and return it  
    }  
    return a ;      // otherwise just return the given character  
}
```

3. **Array Read/Print**

Write a `main()` function to do the following: [5]

-Define an array named `a` of 10 integers.

- Read **five** integers into the array.
- After all integers are read, then print all the read integers from the array.

4. Array Sum

Write a function `int sum(int a[], int n);` [5]
 the first parameter `a[]` is an array, the second parameters says how many integers are in the array. The function simply finds the sum of all the n elements of `a[]` and returns that value.

5. Flying birds

Write a function called `fly()` . It has one parameter named `s` which is a string. [5]
 - It returns 0 or 1 or -1 as defined below:
 - It returns 1 if the string is "sparrow" or "mynah"
 - It returns 0 if the string is "penguin".
 - It returns -1 if it is none of the above

Note: You can use the following C standard library function to compare two strings:

```
int strcmp(char s1[], char s2[]);
```

It compares the strings in the two arrays `s1` and `s2` and returns 0 only if they are identical, for example `strcmp(a,"hello")` will return 0 if the string in `a` is equal to "hello". `strcmp(a,"bye");` will return a non-zero value if `a` has the string "hello".

6. Checking digits:

[5]

Write a function `kap()`. It takes one integer parameter n . If n has in its units place: 4, 9 or 5 then it prints "It is a kap" else it prints "It is not a kap".

Constraint: You must use a **switch-case** and NOT an **if-else**.

7. Searching for TC numbers

[2+8=10]

A TC number is one which can be written as the sum of two-cubes in at least two different ways (with positive integers). For example $152 = 3^3 + 5^3$ is not a TC number because there is no other way to write it as a sum of two cubes. On the other hand, $1729 = 12^3 + 1^3$ and $1729 = 10^3 + 9^3$, so 1729 is a TC number. This problem shows how to find if a number is a TC number.

(a) Write a function with prototype:

```
int checkprod(int a, int b, int t);
```

It tests if $a^3 + b^3$ equals t . If yes, it returns 1, if not it returns 0. Remember that C does not have an exponentiation operator, just repeated multiplies is the way you can do it.

(b) Write another function with prototype:

```
int checktc(int n);
```

it checks if n is a TC number and returns 1 or 0 to say it is or it is not a TC number. To do that it tests every possible (i, j) integer pairs where $i \leq j$. Here is how it works:

- Maintain a variable *count*, see below how it is used.
- Loop over each value of i from 1 to $n - 1$
- For a given i loop over each value of j from i to $n - 1$
- Call `checkprod()` with arguments i, j and n to check if $i^3 + j^3$ equals n
- If it is then increment *count*;
- After checking every such i and j pair and coming out of the two loops, see if *count* is greater than 1, if it is, then the function returns 1 else it returns 0.