

ISHMEET KAUR | 100809450
RISHAB SINGH | 100787473

OS TUTORIAL #2 - CRN74027

Conceptual Questions

1. List each of the modes for the fopen function to perform the following operations: read, write, read and write, append to a file.

- **Read: "r"** Opens a file for reading. The file must exist.
- **Write: "w"** Creates an empty file for writing. If a file with the same name exists, its content is erased.
- **Read and Write: "r+"** Opens a file for both reading and writing. The file must exist.
- **Append: "a"** Opens a file for appending. Data written to the file is added to the end. The file is created if it does not exist.

2. Does dynamic memory use the stack or heap? What is the difference between the stack and heap?

1. **Dynamic Memory: Stack vs. Heap**

- **Dynamic memory** allocation uses the **heap**. The **stack** is used for static memory allocation, including function calls, local variables, and control flow.
- **Stack:** Memory is managed automatically by the compiler. Memory allocation and deallocation are done in a last-in, first-out manner. It's fast but limited in size.
- **Heap:** Memory is managed by the programmer (using **malloc**, **calloc**, **free**, etc.). It's more flexible and can accommodate larger amounts of data, but improper use can lead to memory leaks or fragmentation.

3. Explain what a pointer is, and provide examples (in C code) of how to change the address that a pointer points to and how to access the data the pointer points to.

- A pointer is a variable that stores the memory address of another variable. Pointers are used for dynamic memory management, passing functions as arguments, and operating on arrays.

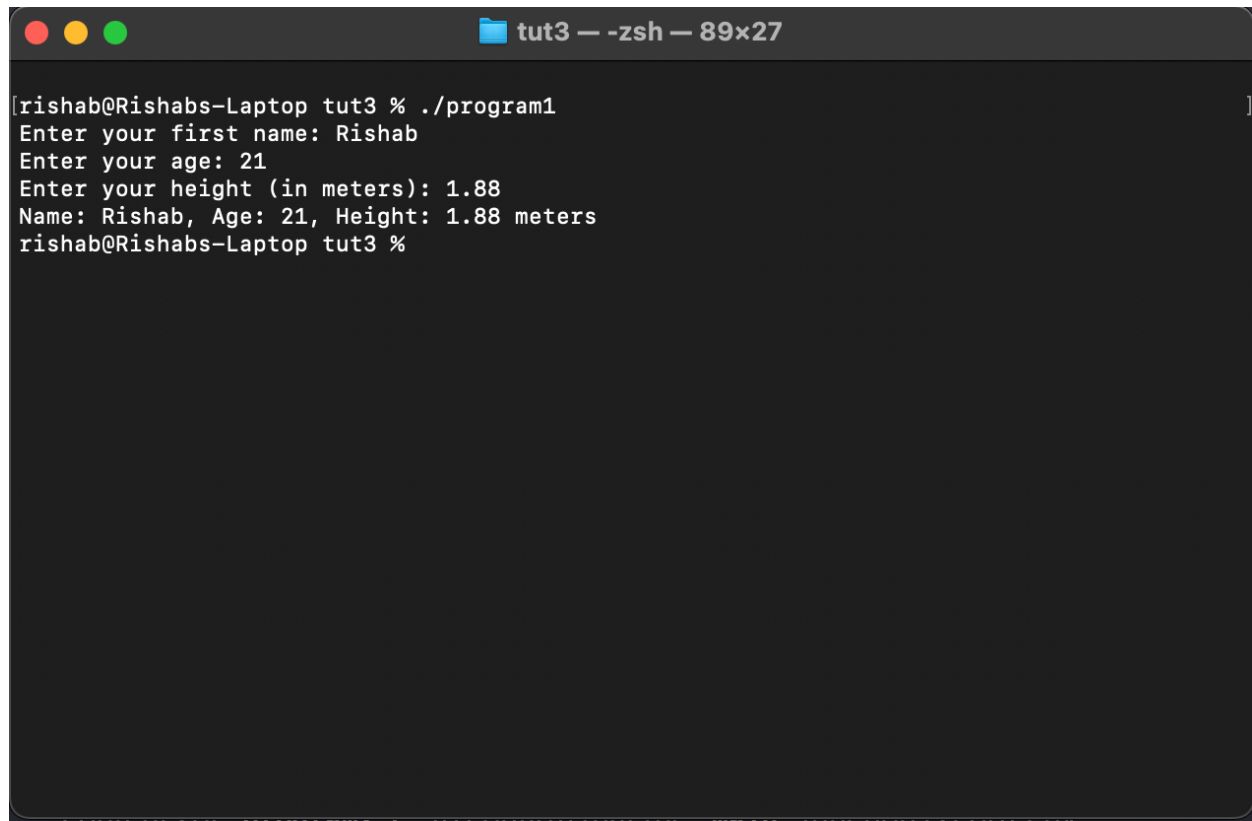
4. Read the documentation on the malloc and free functions and explain briefly how to use malloc.

(memory allocation) is used to dynamically allocate a block of memory on the heap. The function returns a pointer to the allocated memory, or NULL if the allocation fails.

5. What is the difference between malloc and calloc?

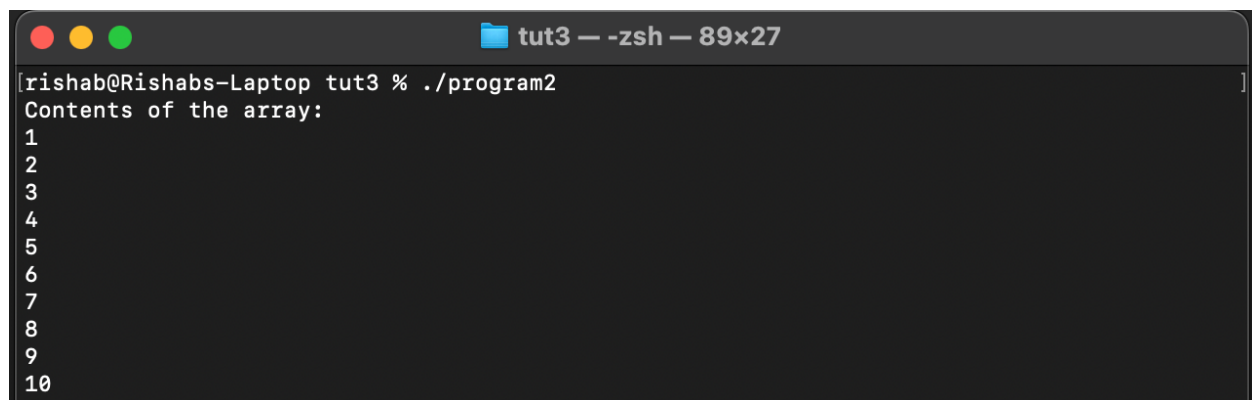
- **malloc** allocates a single block of memory of a specified size and does not initialize the memory. The contents of the allocated memory are indeterminate.
- **calloc** (contiguous allocation) allocates memory for an array of elements, initializes all bits to zero, and returns a pointer to the allocated memory. Syntax:
calloc(numberOfElements, elementSize).

Program1.c:



```
tut3 — -zsh — 89x27
[rishab@Rishabs-Laptop tut3 % ./program1
Enter your first name: Rishab
Enter your age: 21
Enter your height (in meters): 1.88
Name: Rishab, Age: 21, Height: 1.88 meters
rishab@Rishabs-Laptop tut3 %
```

Program2.c



```
tut3 — -zsh — 89x27
[rishab@Rishabs-Laptop tut3 % ./program2
Contents of the array:
1
2
3
4
5
6
7
8
9
10
```

Program3.c

```
rishab@Rishabs-Laptop tut3 % ./program3
Enter your student ID: 100787473
Enter your age: 21
Enter the year you started at UOIT: 2020
Student information saved.
rishab@Rishabs-Laptop tut3 %
```

Program4.c

```
tut3 — -zsh — 80x24
Last login: Tue Feb  6 18:55:43 on ttys000
[rishab@Rishabs-Laptop tut3 % ./program4
Enter your name: Rishab
Enter the number of students to mark: 5
Memory has been successfully freed. Program is terminating.
rishab@Rishabs-Laptop tut3 %
```

Program5.c

```
tut3 — -zsh — 80x24
[rishab@Rishabs-Laptop tut3 % ./program5
Enter your name: Rishab
Enter the number of students to mark: 2
Enter student ID and mark for student 1: 100787473

90
Enter student ID and mark for student 2: 100787472
85
Grading complete. Memory freed.
rishab@Rishabs-Laptop tut3 %
```

File Structure and content:

The image shows a screenshot of a code editor interface. On the left side, there is a file explorer panel with a dark background. It shows a project named "UNTITLED (WORKSPA..." with a folder icon and a refresh icon. Underneath, there is a folder named "tut3" which is expanded. Inside "tut3", there are several files listed: "grades.txt", "program1", "program1.c", "program2", "program2.c", "program3", "program3.c", "program4", "program4.c", "program5", "program5.c", "question2.txt", and "students.txt". The "students.txt" file is currently selected, highlighted with a blue background. On the right side of the editor, there is a code editor area with a dark background. It shows line numbers "1" and "2" on the left, and the text "100787473,21,2020" on line 1.

File Name	Content
grades.txt	
program1	
program1.c	
program2	
program2.c	
program3	
program3.c	
program4	
program4.c	
program5	
program5.c	
question2.txt	
students.txt	