Data Structure

Lab-7

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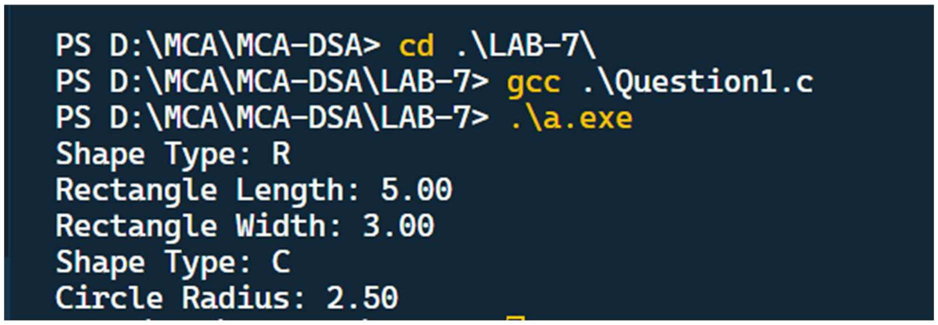
Exp no 1: WAP to demonstrate the union's effectiveness over structure. You can use any previously given structure program to depict the idea.

```c
#include <stdio.h>

// Define a structure for a rectangle
struct Rectangle
{
    char shape_type; // 'R' for rectangle
    float length;
    float width;
};

// Define a structure for a circle
struct Circle
{
    char shape_type; // 'C' for circle
    float radius;
};

// Define a union to store either a rectangle or a circle
union Shape
{
    char shape_type; // To determine the type of shape ('R' for
rectangle, 'C' for circle)
    struct Rectangle rectangle;
    struct Circle circle;
};

int main()
{
    union Shape shape;

    // Store a rectangle in the union
    shape.shape_type = 'R';
    shape.rectangle.length = 5.0;
    shape.rectangle.width = 3.0;

    printf("Shape Type: %c\n", shape.shape_type);
    printf("Rectangle Length: %.2f\n", shape.rectangle.length);
    printf("Rectangle Width: %.2f\n", shape.rectangle.width);

    // Store a circle in the same union
    shape.shape_type = 'C';
    shape.circle.radius = 2.5;

    printf("Shape Type: %c\n", shape.shape_type);
    printf("Circle Radius: %.2f\n", shape.circle.radius);
    return 0;
}
```



```
PS D:\MCA\MCA-DSA> cd .\LAB-7\
PS D:\MCA\MCA-DSA\LAB-7> gcc .\Question1.c
PS D:\MCA\MCA-DSA\LAB-7> .\a.exe
Shape Type: R
Rectangle Length: 5.00
Rectangle Width: 3.00
Shape Type: C
Circle Radius: 2.50
```

Experiment no 2: WAP to demonstrate the various run-time memory allocation approaches like

a. Malloc

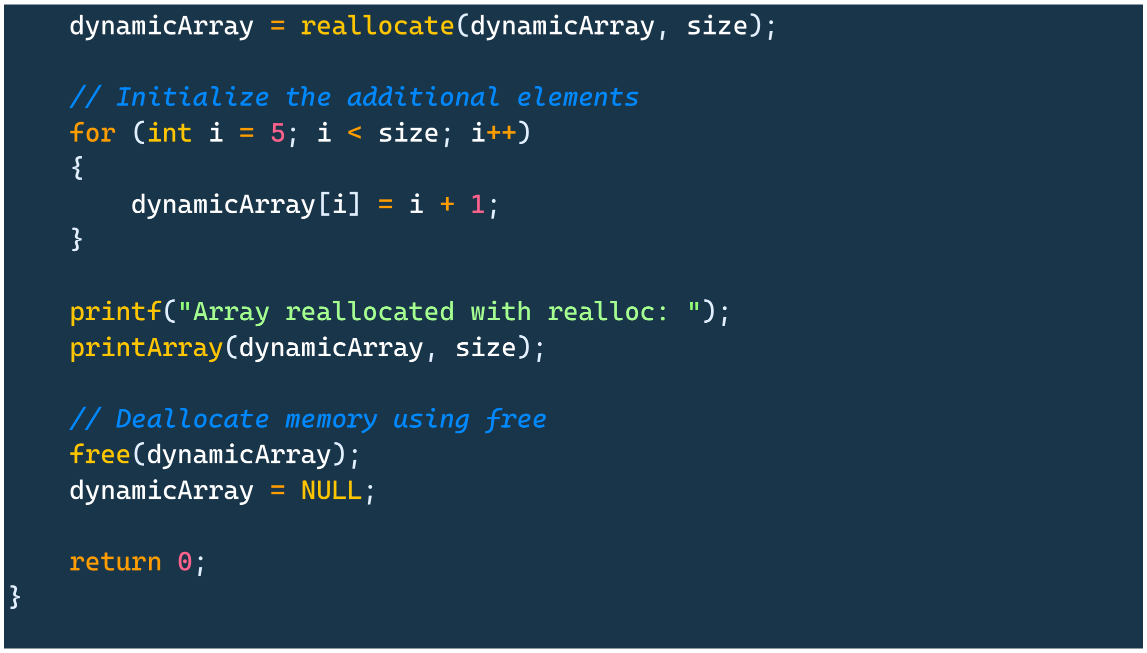
b. Calloc

c. Free

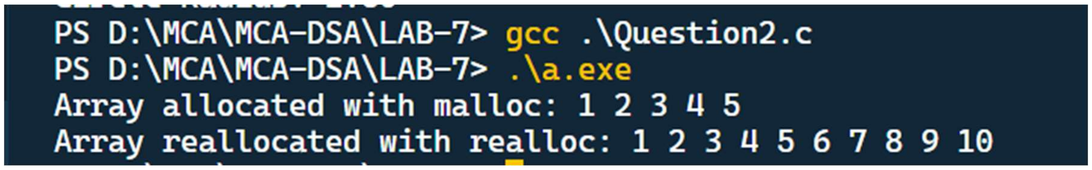
d. Realloc

For implementing this, make use of array, function, and wherever necessary pointer.

```c
#include <stdio.h>
#include <stdlib.h>

// Function to allocate memory using malloc
int *allocateWithMalloc(int size)
{
    int *arr = (int *)malloc(size * sizeof(int));
    if (arr == NULL)
    {
        printf("Memory allocation with malloc failed.\n");
        exit(1);
    }
    return arr;
}

// Function to allocate memory using calloc
int *allocateWithCalloc(int size)
{
    int *arr = (int *)calloc(size, sizeof(int));
    if (arr == NULL)
    {
        printf("Memory allocation with calloc failed.\n");
        exit(1);
    }
    return arr;
}

// Function to reallocate memory using realloc
int *reallocate(int *arr, int newSize)
{
    int *newArr = (int *)realloc(arr, newSize * sizeof(int));
    if (newArr == NULL)
    {
        printf("Memory reallocation with realloc failed.\n");
        free(arr); // Release the original memory
        exit(1);
    }
    return newArr;
}

// Function to print an array
void printArray(int *arr, int size)
{
    for (int i = 0; i < size; i++)
    {
        printf("%d ", arr[i]);
    }
    printf("\n");
}

int main()
{
    int *dynamicArray = NULL;
    int size = 5;

    // Allocate memory using malloc
    dynamicArray = allocateWithMalloc(size);

    // Initialize the array
    for (int i = 0; i < size; i++)
    {
        dynamicArray[i] = i + 1;
    }

    printf("Array allocated with malloc: ");
    printArray(dynamicArray, size);

    // Reallocate memory using realloc
    size = 10;
```



```c
    dynamicArray = reallocate(dynamicArray, size);

    // Initialize the additional elements
    for (int i = 5; i < size; i++)
    {
        dynamicArray[i] = i + 1;
    }

    printf("Array reallocated with realloc: ");
    printArray(dynamicArray, size);

    // Deallocate memory using free
    free(dynamicArray);
    dynamicArray = NULL;

    return 0;
}
```



```
PS D:\MCA\MCA-DSA\LAB-7> gcc .\Question2.c
PS D:\MCA\MCA-DSA\LAB-7> .\a.exe
Array allocated with malloc: 1 2 3 4 5
Array reallocated with realloc: 1 2 3 4 5 6 7 8 9 10
```