# Assignment_20-08-2024

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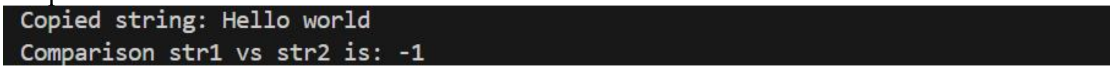
1. Implementation of memcpy and strcmp with void pointers
https://elixir.bootlin.com/linux/v6.10/source/lib/string.c

```
#include <stdio.h>

// Implementation of memcpy
void *memcpy(void *dest, const void *src, int n)
{
    char *dest_ptr = (char *)dest;
    const char *src_ptr = (const char *)src;
    for (int i = 0; i < n; i++)
    {
        dest_ptr[i] = src_ptr[i];
    }
    return dest;
}
// Implementation of strcmp
int strcmp(const void *s1, const void *s2)
{
    const char *str1 = (const char *)s1;
    const char *str2 = (const char *)s2;
    while (*str1 != '\0' && *str2 != '\0')
    {
        if (*str1 < *str2)
            return -1;
        else if (*str1 > *str2)
            return 1;
        str1++;
        str2++;
    }
    if (*str1 == '\0' && *str2 != '\0')
        return -1;
    else if (*str1 != '\0' && *str2 == '\0')
        return 1;
    else
        return 0;
}
int main()
{
    char src[] = "Hello, World!";
    char dest[20];
    // Test memcpy
    memcpy(dest, src, sizeof(src));
    printf("Copied string: %s\n", dest);
    // Test strcmp
    char str1[] = "Hello";
    char str2[] = "World";
    int result = strcmp(str1, str2);
    printf("Comparison result: %d\n", result); // output -1
    return 0;
}
```

Output:



```
Copied string: Hello world
Comparison str1 vs str2 is: -1
```

## 2. what is dynamic initalization in C++, how it is possible in C++ during runtime

Dynamic initialization in C++ refers to the process of initializing variables during runtime, as opposed to compile-time initialization. This is particularly useful when the value of a variable is not known until the program executes.

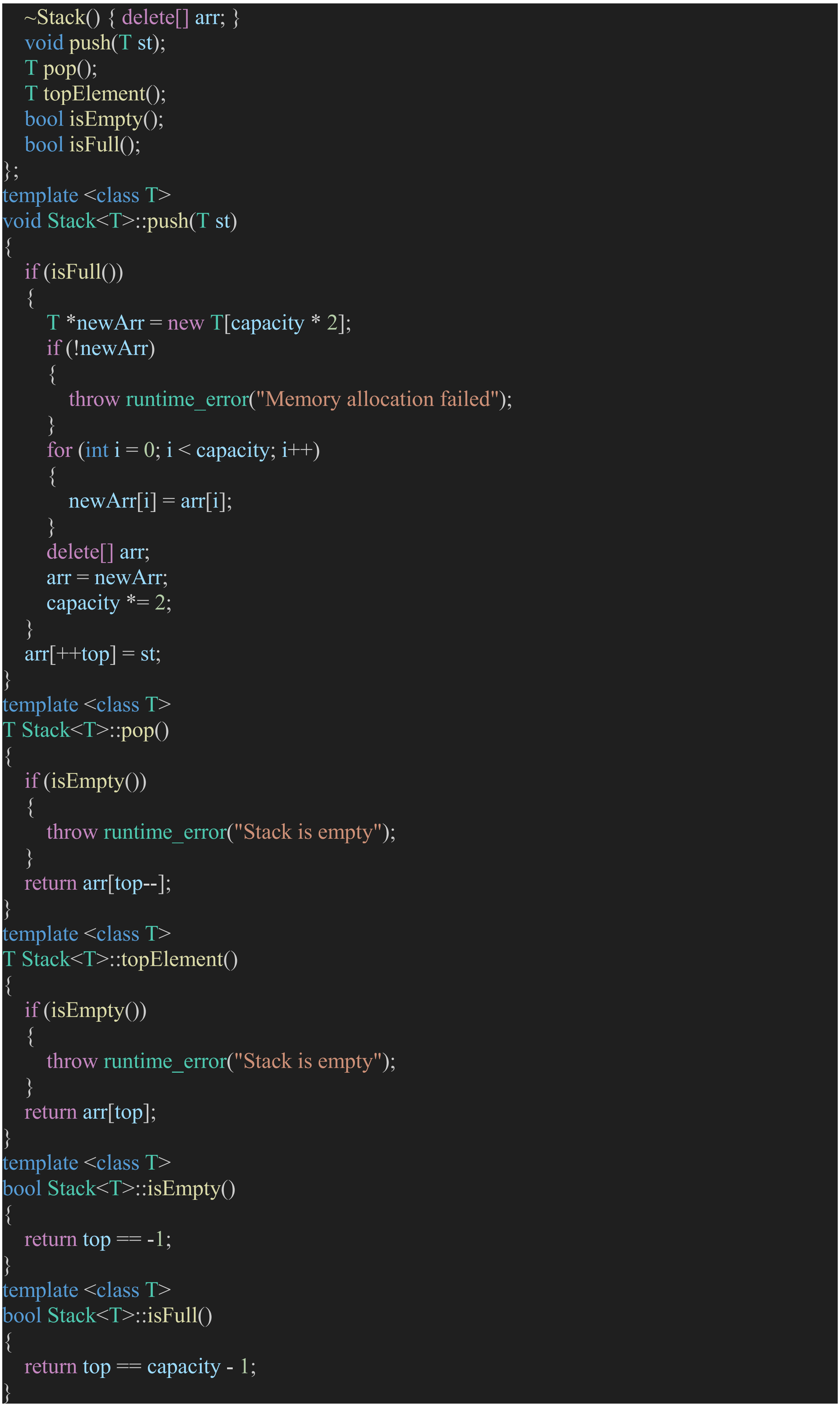
Dynamic initialization is possible in C++ through various mechanisms, such as:

- **Constructor Initialization**: Objects can be dynamically initialized when their constructors are called, which might include reading data from files, user input, or performing calculations.
- **Dynamic Memory Allocation**: Using dynamic memory allocation (new and delete), you can create and initialize objects or variables at runtime.

```
#include <iostream>

class Example {
public:
    int x;
    Example(int val) : x(val) {  // Constructor initializing dynamically
        std::cout << "Initialized x to " << x << std::endl;
    }
};
int main() {
    int userInput;
    std::cout << "Enter a value: ";
    std::cin >> userInput;
    Example obj(userInput);  // Object is dynamically initialized with runtime input

    return 0;
}
```

## 3. Implement stack data structure by using template class.

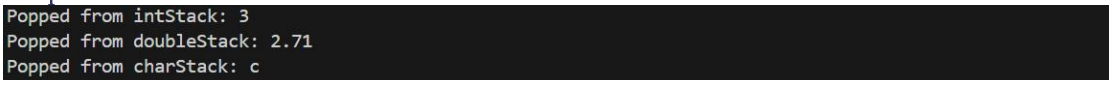
```
#include <iostream>
using namespace std;

template <class T>
class Stack
{
private:
    int top;
    int capacity;
    T *arr;
public:
    Stack(int size = 10) : top(-1), capacity(size), arr(new T[capacity]) {}
```



```
    ~Stack() { delete[] arr; }
    void push(T st);
    T pop();
    T topElement();
    bool isEmpty();
    bool isFull();
};
template <class T>
void Stack<T>::push(T st)
{
    if (isFull())
    {
        T *newArr = new T[capacity * 2];
        if (!newArr)
        {
            throw runtime_error("Memory allocation failed");
        }
        for (int i = 0; i < capacity; i++)
        {
            newArr[i] = arr[i];
        }
        delete[] arr;
        arr = newArr;
        capacity *= 2;
    }
    arr[++top] = st;
}
template <class T>
T Stack<T>::pop()
{
    if (isEmpty())
    {
        throw runtime_error("Stack is empty");
    }
    return arr[top--];
}
template <class T>
T Stack<T>::topElement()
{
    if (isEmpty())
    {
        throw runtime_error("Stack is empty");
    }
    return arr[top];
}
template <class T>
bool Stack<T>::isEmpty()
{
    return top == -1;
}
template <class T>
bool Stack<T>::isFull()
{
    return top == capacity - 1;
}
```

```
int main()
{
    try
    {
        Stack<int> intStack;
        Stack<double> doubleStack;
        Stack<char> charStack;
        // Push some elements onto the stacks
        intStack.push(1);
        intStack.push(2);
        intStack.push(3);
        doubleStack.push(3.14);
        doubleStack.push(2.71);
        charStack.push('a');
        charStack.push('b');
        charStack.push('c');
        // Pop elements from the stacks
        cout << "Popped from intStack: " << intStack.pop() << endl;
        cout << "Popped from doubleStack: " << doubleStack.pop() << endl;
        cout << "Popped from charStack: " << charStack.pop() << endl;
    }
    catch (const runtime_error &e)
    {
        cerr << "Error: " << e.what() << endl;
        return 1;
    }
    return 0;
}
```

Output:



```
Popped from intStack: 3
Popped from doubleStack: 2.71
Popped from charStack: c
```

## 4. C/C++ files vs Database software tools usage

| Feature | C/C++ Files | Database Software Tools |
|---|---|---|
| **Data Storage Method** | Directly stores data in text or binary files | Stores data in tables with structured queries (SQL/NoSQL) |
| **Complexity** | Simple, direct file I/O (Input/Output) | More complex, requires setup and management of DBMS |
| **Data Size** | Suitable for small or moderate datasets | Designed for large-scale datasets |
| **Data Integrity** | No built-in data integrity checks | Built-in mechanisms for data integrity (ACID properties) |

| | | |
|---|---|---|
| **Concurrency** | Limited support, prone to conflicts | Strong concurrency handling, supports multiple users |
| **Security** | Requires custom implementation for encryption and access control | Built-in security features such as authentication and access control |
| **Efficiency** | Efficient for simple, small-scale applications | Optimized for complex queries and large datasets |
| **Scalability** | Poor scalability for large datasets and multi-user environments | Highly scalable, suited for growing datasets and concurrent users |
| **Querying Data** | Manual parsing and handling | Advanced querying capabilities (SQL/NoSQL languages) |
| **Setup & Maintenance** | Minimal setup, no external software needed | Requires installation, configuration, and maintenance of a DBMS |
| **Use Case** | Best for small applications with simple data storage needs | Best for applications that require complex data management and multi-user support |
| **When to use** | Small and simple data storage requirements.<br>Minimal data manipulation and no need for advanced queries.<br>Single-user applications or lightweight systems. | Applications with large datasets.<br>Need for data integrity, security, and multi-user access.<br>Complex data relationships and querying requirements. |