Data Structure Assignment 2

ID: E14066282	**Name:** 溫梓傑	**Department:** ME 110

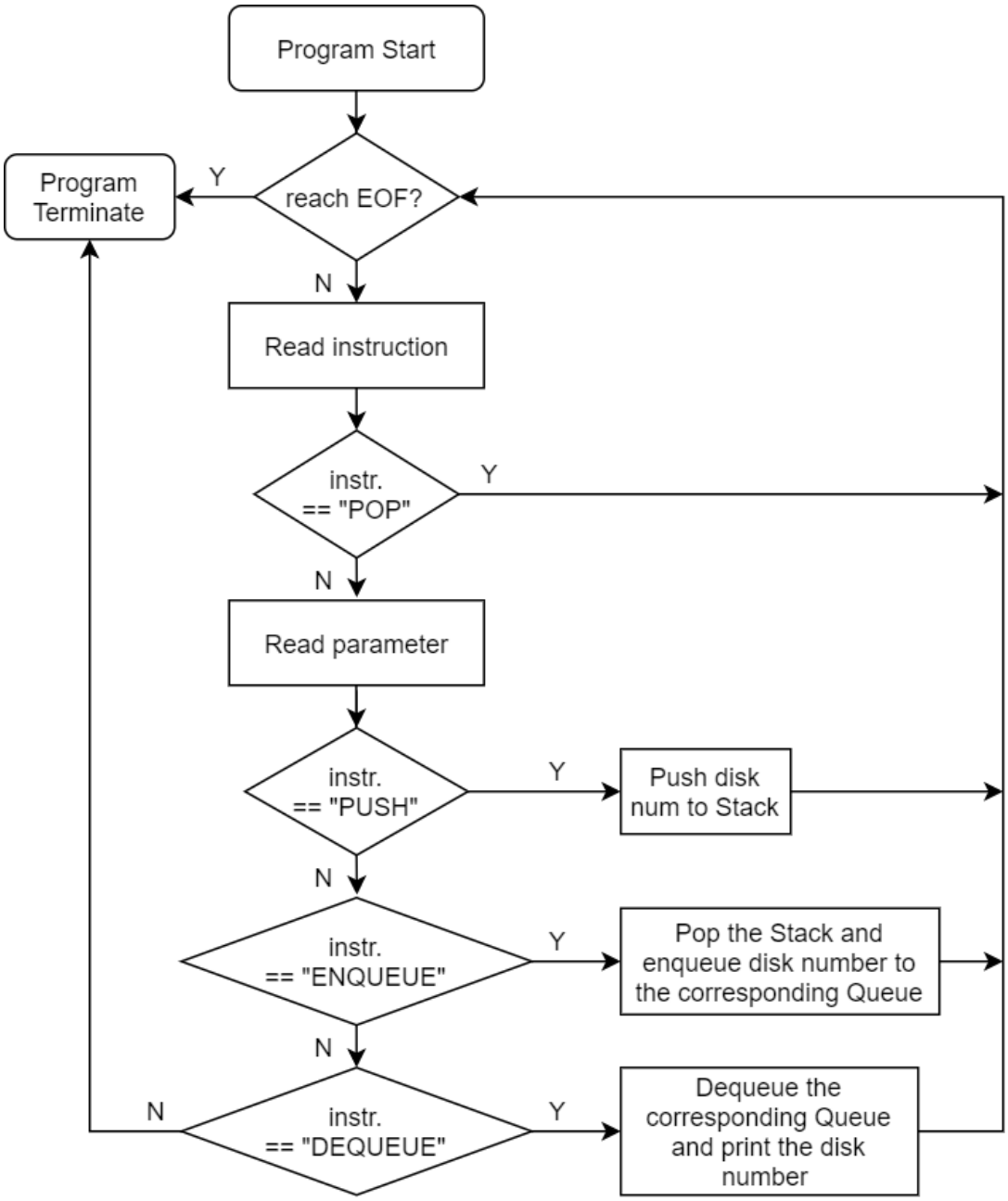
○ Result Screenshots

```
C:\2020-NCKU_DS\HW2_stack_queue\code>make
gcc -std=c11 -o food food.c

C:\2020-NCKU_DS\HW2_stack_queue\code>.\food
54
98
3
1
30
```

Figure 1 Screenshot of command line

○ Program Architecture



○ Program Functions

1. 📒 Stack.h

```
Stack *new_Stack();
```

Constructs a new stack.

📐 Parameters

None.

⮌ Return Value

Returns the new pointer of the stack.

- If construction fails, returns NULL.

```
int pop(Stack *self);
```

Removes the element on the top of the stack.

📐 Parameters

`self`

The pointer of the stack.

⮌ Return Value

Returns the top element before removal.

- If the stack is empty, program terminates.

```
void push(Stack *self, const int x);
```

Inserts a new element on the top of the stack.

📐 Parameters

`self`

The pointer of the stack.

`x`

The element which you insert.

⮌ Return Value

None.

---

2. 📒 **Queue.h**

```
Queue *new_Queue();
```

Constructs a new queue.

📐 Parameters

None.

⮌ Return Value

Returns the new pointer of the queue.

- If construction fails, returns NULL.

```
int dequeue(Queue *self x);
```

Removes the element in front of the queue.

📐 Parameters

`self`

The pointer of the queue.

⮌ Return Value

Returns the front element before removal.

- If the queue is empty, program terminates.

```
void enqueue(Queue *self, const int x);
```

Inserts a new element on the rear of the queue.

📐 Parameters

`self`

The pointer of the queue.

`x`

The element which you insert.

⮌ Return Value

None.

○ Program Design

由於本作業需使用一個 Stack 與兩個 Queue，非常適合使用物件的概念來實作，但是受限於 C 語言並沒有 C++物件導向的特性，因此只能折衷的使用 struct 搭配 function 來模擬 C++中的物件。

為了讓程式敘述更為簡潔，我利用 typedef 來定義 Stack 以及 Queue。

```
typedef struct // Stack.h
{
    int stack[STACK_MAX];
    int top;
} Stack;

typedef struct // Queue.h
{
    int queue[QUEUE_MAX];
    int front; // No element
    int rear;  // Element exits after first enqueue
} Queue;
```

如此就能讓 Compiler 識別 Stack 以及 Queue 兩組關鍵字，就好像在 C++實作 class 一樣。

另外遇到的問題就是，如何把物件新增的方法做的類似 C++，參考了一些網站 [Ref 1]，最後決定用以下方法實作。

C++：

```
Stack *Plate = new Stack;
```

C：

```
Stack *new_Stack()
{
    Stack *p = (Stack *)calloc(1, sizeof(Stack));
    p->top = -1;
    return p;
}
```

○ Reference

- Ref 1
  https://michaelchen.tech/applied-c-programming/object-oriented-programming-primer/

- **Operating System**
  Windows 10
- **Compiler**
  (MinGW.org GCC Build-20200227-1) 9.2.0
- **Compile**
  make
- **Run**
  .\food.exe