MIDDLE EAST TECHNICAL UNIVERSITY, NORTHERN CYPRUS CAMPUS
CNG140 C Programming – Programming Assignment 1

**Date handed out:** **1 April 2021, Thursday**
**Date submission due:** **15 April 2021, Thursday, @23:55**

# Programming Assignment 1: Octal to Binary Encoder

## Purpose:

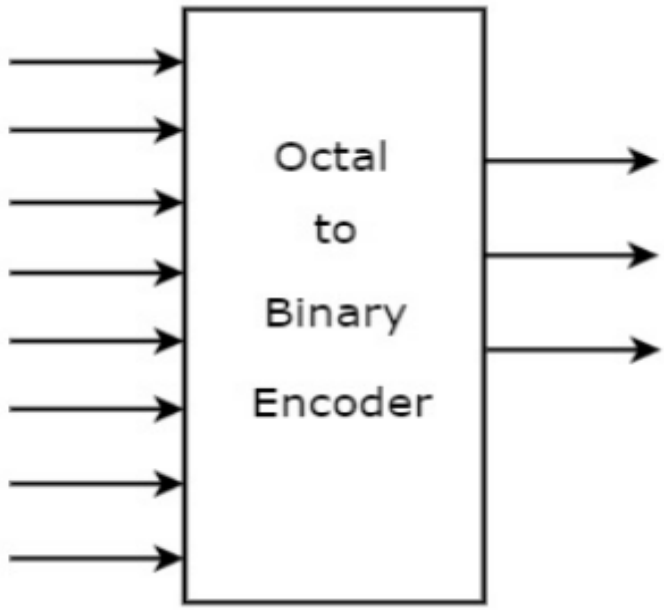
The main purpose of this programming assignment is to revise the topics that we have covered in the first three weeks including fundamentals of C programming, conditional statements and repetitive statements. In this assignment, you will also practice character data types.

## Description:

An encoder is a digital circuit that performs the inverse operation of a decoder. An octal to binary encoder consists of eight input lines and three output lines. Each input line corresponds to each octal digit and three outputs generate corresponding binary code. In encoders, it is to be assumed that only one input is active or has a value 1 at any given time. In this programming exercise, your task is to write a command-line application that takes the input to an encoder, and returns the three output generated by an encoder.

## Programming Requirements:

An octal to binary encoder is designed in such a manner that it can take 8 inputs and produce 3-bit outputs.
The figure below shows the block diagram of a octal to binary encoder:




The truth table for the encoder is:

| Inputs | | | | | | | | Outputs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $D_7$ | $D_6$ | $D_5$ | $D_4$ | $D_3$ | $D_2$ | $D_1$ | $D_0$ | $Y_2$ | $Y_1$ | $Y_0$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |

When the user first runs the program, you will display the following menu:

Welcome to Octal-to-Binary Encoder!
(1) Compute and Display the outputs
(2) Quit

Depending on the option given by the user, your program will work as follows:

**Option 1:** When the user chooses this option, your program will first ask you to enter 8-digit binary inputs. If more than 8 bits is entered, then your program should print an error message and ask the user to re-enter the input. 8 digits will be used as 8 inputs required by the encoder. First digit is D7, the second digit is D6 and the last digit is D0.

The inputs can be entered in base 2 or base 10. If the user enters in base 2, then you will not need to make base conversions. However, if the user enters in base 10, then you will need to convert it to binary. If the user enters a value >255 in base 10, then your program will display "not possible to convert it to 8-digit binary number" and will ask the user to re-enter the value again.

Which base will you use to enter input (base 2 or base 10)? 2
Please enter your input: 00001000

From the above table, the output Y2 becomes 1 if any of the digits D4 or D5 or D6 or D7 is one. Thus, we can write its expression as

Y2 = D4 OR D5 OR D6 OR D7

Similarly, Y1 = D2 OR D3 OR D6 OR D7 and

Y0 = D1 OR D3 OR D5 OR D7

Please note that when all the inputs are zero, an output with all 0's is generated.
For your reference, the truth table for bitwise OR is:

| X( where X is a single bit) | Y( where Y is a single bit) | X OR Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

If the user selects **option 2 (Quit),** then your program will stop.

If the user enters an invalid input for base 2 or base 10 then your program will display "invalid number in base 2/10" and will ask the user to re-enter the value again.

If the user inputs is <8 digits in base 2 then your program will display "You entered less than 8 bits! Please try again!" and will ask the user to re-enter the value again.

### Sample Run:

```
Welcome to Octal to Binary Encoder!

   (1) Compute and Display the outputs
   (2) Quit
You choose: 1
You have chosen option 1

Which base will you use to enter input (base 2 or base 10)? 2
Please enter your input: 00000010
Y2 is 0 Y1 is 0 Y0 is 1

Welcome to Octal to Binary Encoder!

   (1) Compute and Display the outputs
   (2) Quit
You choose: 1
You have chosen option 1

Which base will you use to enter input (base 2 or base 10)? 10
Please enter your input: 300
Decimal 300 cannot be represented with 8 bits. Please try again!
Please enter your input: 16
Y2 is 1 Y1 is 0 Y0 is 0


Welcome to Octal to Binary Encoder!

   (1) Compute and Display the outputs
   (2) Quit
You choose: 1
You have chosen option 1

Which base will you use to enter input (base 2 or base 10)? 10
Please enter your input: 0
Y2 is 0 Y1 is 0 Y0 is 0

Welcome to Octal to Binary Encoder!

   (1) Compute and Display the outputs
   (2) Quit
You choose: 1
You have chosen option 1

Which base will you use to enter input (base 2 or base 10)? 2
Please enter your input: 22
22 is not a valid number in base 2! Please try again!
```

```
Please enter your input: 111000001
You entered more than 8 bits! Please try again!
Please enter your input: 11100000
Y2 is 1 Y1 is 1 Y0 is 1

Welcome to Octal to Binary Encoder!

   (1) Compute and Display the outputs
   (2) Quit
You choose: 1
You have chosen option 1

Which base will you use to enter input (base 2 or base 10)? 2
Please enter your input: 0101
You entered less than 8 bits! Please try again!
Please enter your input: 00001000
Y2 is 0 Y1 is 1 Y0 is 1

Welcome to Octal to Binary Encoder!

   (1) Compute and Display the outputs
   (2) Quit
You choose: 2
You have chosen option 2
BYEE!!
```

## Grading Schema:

Your program will be graded as follows:

| **Grading Point** | **Mark (100)** |
|---|---|
| The menu(keeping the users in a loop until exit is chosen) | 10 |
| Reading input | 10 |
| Converting to base 2 | 25 |
| Displaying error messages | 20 |
| Finding the output | 25 |
| Code quality (e.g., formatting, commenting, naming variables, clean use of C constructs such as formulation of selection statements and loops, etc)[1] | 10 |

## If you donot obey the rules then you will automatically get 0.

## Rules:

Please make sure that you follow the restrictions for the assignment as follows.

- **Strictly obey the input output format. Do not print extra things.**
- **You are not allowed to use global variables and goto statements.**
- **You are not allowed to use data structures such as arrays to store values as we have not covered them in the class yet.**
- **You are not allowed to define your own functions as we have not covered them in the class yet.**
- **You are not allowed to use bitwise operators.**
- **Add your name/surname and ID at the top of your code as comments and name your source file "Name-Surname-StudentID.c".**
- **Submit your solution as C and PDF to odtuclass. Do not compress it (zip, rar, …).**

[1] See guidelines given here: https://www.gnu.org/prep/standards/html_node/Writing-C.html