CSI104: Foundations Of Computer Science

**Duration: 3 hours**

**Lab 1:**

**Objective**:

* Describe the decimal, binary, hexadecimal, and octal system.
* Convert a number in binary, octal, or hexadecimal to a number in the decimal system.
* Convert a number in the decimal system to a number in binary, octal, and hexadecimal.
* Convert a number in binary to octal and vice versa.

**Materials:**

Based on exercises of chapter 2 in the textbook “Foundations Of Computer Science, 4nd Edition, Behrouz Forouzan, 2017.”

**Student's task:**

* Review the whole chapter 2 content in the textbook.
* Write down solutions to exercises (step by step)
* Finish exercises and submit the results to the lecturer in class.

**Scoring scale: 10**

**Exercise 1** **(2.5 marks): Convert decimal numbers to binary ones**

|  |  |  |  |
| --- | --- | --- | --- |
| **Decimal** | **8-bit Binary** | **Decimal** | **16-bit Binary** |
| 9 | 0000 1001 | -7 | 1111 1111 1111 1001 |
| 12 | 0000 1100 | -34 | 1111 1111 1101 1110 |
| 23 | 0001 0111 | -26 | 1111 1111 1110 0110 |
| 16 | 0001 0000 | -34 | 1111 1111 1101 1110 |
| 127 | 0111 1111 | -127 | 1111 1111 1000 0001 |
| 256 | Overflow  9-bit binary:  1 0000 0000 | 15.75 | 0100 1011 1110 0000 |
| 111 | 0110 1111 | 12.35 | 0100 1010 0010 1100 |
| 190 | 1011 1110 | 25.625 | 0100 1110 0110 1000 |

**Exercise 2 (2.5marks): Convert decimal numbers to binary and hexadecimal ones**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Decimal** | **Binary** | **Hexa.** | **Decimal** | **16-bit Binary** | **Hexadecimal** |
| 9 | 1001 | 9 | 255 | 0000 0000 1111 1111 | 00FF |
| 25 | 0001 1001 | 19 | 256 | 0000 0001 0000 0000 | 0100 |
| 125 | 0111 1101 | 7D | 188 | 0000 0000 1011 1100 | 00BC |
| 157 | 1001 1101 | 9D | 312 | 0000 0001 0011 1000 | 0138 |
| 162 | 1010 0010 | A2 | 517 | 0000 0010 0000 0101 | 0205 |

**Exercise 3 (2.5 marks): Compute** (b: binary, q: octal, h: hexadecimal)  
Integers are presented in two’s complement

**0011 0000 b + 0010 0000 b = 0101 0000 b**

**0011 1100 b + 1100 1011 b = 1 0000 0111 b**

**1011 1000 b - 0111 0011 b = 1 0100 0101 b  
1001 0011 b - 1100 0010 b = 1101 0001 b**

**Exercise 4 (2.5 marks)**

1. Show binary formats of 1-byte unsigned numbers: 251, 163, 117

* 251d = 1111 1011b
* 163d = 1010 0011b
* 117d = 0111 0101b

1. Show binary formats of 2-byte unsigned numbers: 551, 160, 443

* 551d = 0000 0010 0010 0111b
* 160d = 0000 0000 1010 0000b
* 443d = 0000 0001 1011 1011b

1. Show binary formats of 1-byte signed numbers: -51, -163, -117, 320

* -51d = 1100 1101b
* -163d = 1 0101 1101b (Overflow)
* -117d = 1000 1011b
* 320d = 1 0100 0000b (Overflow)

1. Show the decimal values of 1-byte unsigned representations: :

01100011b, 10001111b, 11001010b, 01001100b

* 01100011b = 99d
* 10001111b = 143d
* 11001010b = 202d
* 01001100b = 76d