CSI106: Foundations Of Computer Science

**Duration: 90’**

**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** | **4-bit Binary** | **Decimal** | **8-bit Binary** | **Decimal** | **16-bit Binary** |
| 9 | 1001 | 7 | **00000111** | 255 | **0000000011111111** |
| 7 | **0111** | 34 | **00100010** | 192 | **0000000011000000** |
| 2 | **0010** | 125 | **01111101** | 188 | **0000000010111100** |
| 15 | **1111** | 157 | **10011101** | 312 | **0000000100111000** |
| 12 | **1100** | 162 | **10100010** | 517 | **0000001000000101** |
| 11 | **1011** | 37 | **00100101** | 264 | **0000000100001000** |
| 6 | **0110** | 66 | **01000010** | 543 | **0000001000011111** |
| 5 | **0101** | 77 | **01001101** | 819 | **0000001100110011** |
| 8 | **1000** | 88 | **01011000** | 1027 | **0000010000000011** |
| 13 | **1101** | 99 | **01100011** | 2055 | **0000100000000111** |
| 14 | **1110** | 109 | **01101101** | 63 | **0000000000111111** |

**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 |
| 127 | 0111 1111 | 9F | 192 | **0000 0000 11000 000** | **00C0** |
| 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** |
| 37 | **0010 0101** | **25** | 264 | **0000 0001 0000 1000** | **0108** |
| 66 | **0100 0010** | **42** | 543 | **0000 0010 0001 1111** | **021F** |
| 77 | **0100 1101** | **4D** | 819 | **0000 0011 0011 0011** | **0333** |
| 88 | **0101 1000** | **58** | 1027 | **0000 0100 0000 0011** | **0403** |
| 99 | **0110 0011** | **63** | 2055 | **0000 1000 0000 0111** | **0807** |
| 109 | **0110 1101** | **6D** | 63 | **0000 0000 0011 1111** | **003F** |

**Exercise 3 (2.5 marks): Compute** (b: binary, q: octal, h: hexadecimal)

**3245q + 247q = 3514 q = 0000 0111 0100 1100 b**

**1A7Bh + 26FE7h = 28A62 h = 00101000101001100010 b**

**1101101101b - 10110111b = 1010110110 b**

**3654q – 337q = 3315 q = 11011001101 b**

**3AB7h – 1FAh = 38BD h = 0011100010111101 b**

**36Ah – 576q = 1EC h = 000111101100 b**

**64AEh – 1001101b= 62141 q**

101101111b

+ 100111011b

110110001b

110001101b

1011010b\* 1011b = **1111011110** b

1101000b + 2ABh + 345q = **3F8** h = **1770** q

3AFh / 1Ch = **100001.1010101110000101001** b = **33.67** d

3ACh – 562q = **1000111010** b = **570** d

3FFAh / 327q = **1001100.00101110000101001** b = **76.18** d

**Exercise 4 (2.5 marks)**

1. Show binary formats of 1-byte unsigned numbers: 251, 163, 117
2. Show binary formats of 2-byte unsigned numbers: 551, 160, 443
3. Show binary formats of 1-byte signed numbers: -51, -163, -117, 320
4. Show the decimal values of 1-byte unsigned representations: :

01100011b, 10001111b, 11001010b, 01001100b

1. 251(10) = **11111011**(2)

163(10)­­ = **10100011**(2)

117(10) = **01110101**(2)

1. 551(10) = **0010001000101111**(2)

160(10) = **0000000010100000**(2)

443(10) = **0000000110101111**(2)

1. -51(10) = **11001101**(2)

-163(10) = **01011101**(2)

-117(10) = **10001011**(2)

320(10) = **0000000101000000**(2)

1. 01100011(2) = **99**(10)

10001111(2) = **143**(10)

11001010(2) = **202**(10)

01001100(2) = **76**(10)