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# **CSI104: Foundations Of Computer Science**

**Duration: 80’**

**Lab 1:**

**Objective**:

* Describe the decimal, binary, hexadecimal, and octal systems.
* 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, octal, and hexadecimal ones**

|  |  |  |  |
| --- | --- | --- | --- |
| **Decimal** | **8-bit Binary** | **Octal** | **Hexadecimal** |
| 1 | 00000001 | 1 | 1 |
| 2 | 00000010 | 2 | 2 |
| 9 | 00001001 | 11 | 9 |
| 15 | 00001111 | 17 | F |
| 127 | 01111111 | 177 | 7F |
| 156 | 10011100 | 234 | 9C |
| 164 | 10100100 | 244 | A4 |
| 214 | 11010110 | 326 | D6 |
| 243 | 11110011 | 363 | F3 |
| 254 | 11111110 | 376 | FE |
| **Decimal** | **16-bit Binary** | **Octal** | **Hexadecimal** |
| 819 | 0000001100110011 | 1463 | 333 |
| 1027 | 0000010000000011 | 2003 | 403 |
| 2055 | 0000100000000111 | 4007 | 807 |
| 543 | 0000001000011111 | 1037 | 21F |
| 75 | 0000000001001011 | 113 | 4B |
| 1120 | 0000010001100000 | 2140 | 460 |
| 34 | 0000000000100010 | 42 | 22 |
| 120 | 0000000001111000 | 170 | 78 |
| 43 | 0000000000101011 | 53 | 2B |
| 3400 | 0000110101001000 | 6510 | D48 |

**Exercise 2 (2 marks): Compute** (d: decimal, b: binary, q: octal, h: hexadecimal), showing your work step by step.

1. 1245q + 247q = ?q = ?b

5+7 = 4

4+4 = 1 ( add 1)

2+2 = 5 ( add 1)

1 + 0 = 1

1245q + 247q = 1514q

1 = 001, 5 = 101, 1 = 001, 4 = 100 => 1514q = 001101001100b

1. 2A7Bh + 26FE7h = ?h = ?b

Làm tương tự câu 1 ta có:

2A7Bh + 26FE7h = 29A62h = 00101001101001100010b

1. 1101100001b - 10000111b =101001100111011011b
2. 3654q – 337q =?q = ?b
3. 1AB7h – 1FAh = ?h = ?b
4. 36Ah – 76q = ?h = ?b
5. 64AEh – 1001101b= ?q

101101111b

+ 101111011b

100110001b

110101101b

1. 1101000b + 2ABh + 325q = ?h = ?q
2. 3AFh / 1Ch =?b = ?d

**Exercise 3 (2 marks):** Convert the following binary numbers to octal and hexadecimal without using a calculator, showing your work step by step:

Binary numbers to octal numbers:

1. (10101)2

Group each 3 binary digit: (10101)2 = (010 101)2 = (25)8

Group each 4 binary digit: (10101)2 = (0001 0101)2 = (15)16

1. (1101000)2

Group each 3 binary digit: (1101000)2 = (001 101 000)2 = (150)8

Group each 4 binary digit: (1101000)2 = (0110 1000)2 = (68)16

1. (010110.01)2

Group each 3 binary digit: (010110.01)2 = (010 110. 010)2 = (26.2)8

Group each 4 binary digit: (010110.01)2 = (0001 0110.0100)2 = (16.4)16

1. (100111.111)2

Group each 3 binary digit: (100111.111)2 = (100 111. 111)2 = (47.7)8

Group each 4 binary digit: (100111.111)2 = (0010 0111.1110)2 = (27.E)16

Binary numbers to hexadecimal numbers:

1. (10101)2
2. (1101000)2
3. (010110.01)2
4. (100111.111)2

**Exercise 4 (2 marks):** Convert the following octal numbers to hexadecimal without using a calculator, showing your work (step by step):

1. (247)8

2 = 0102 , 4 = 1002 , 7 = 1112

Thus, (247)8 = (010100111)2

Group each 4 binary digit : (0000 1010 0111) => (0A7)16 or (A7)16 exactly

1. (1245)8

1 = 0012 , 2 = 0102 , 4 = 1002 , 5 = 1012

Thus, (1245)8 = (001010100101)2

Group each 4 binary digit : (0010 1010 0101) => (2A5)16

1. (3654.7)8

3 = 0112 , 6 = 1102 , 5 = 1012 , 4 = 1002 , 7 = 1112

Thus, (3654.7)8 = (011 110 101 100.111)2 = (11110101100.111)2

Group each 4 binary digit : (0111 1010 1100.1110) => (7AC.E)16

1. (337)8

3 = 0112 , 3 = 0112 , 7 = 1112

Thus, (337)8 = (011011111)2

Group each 4 binary digit : (0000 1101 1111) => (0DF)16 or (DF)16 exactly

**Exercise 5 (1.5 marks):** Convert the following decimal numbers to binary using the alternative method discussed in Example 2.17, showing your work (step by step):

1. 47

Place value: 2^5 , 2^4 ,…, 2^0

47 = 32 + 0 + 8 + 4 + 2 + 1

Binary: 101111

1. 89

Place value: 2^6 , 2^5 ,…, 2^0

89 = 64 + 0 + 16 + 8 + 0 + 0 + 1

Binary: 1011001

1. 128

Place value : 2^7, 2^6, … , 2^0

128 = 128 + 0 + 0 + 0 + 0 + 0 + 0 + 0

Binary: 10000000

1. 240

Place value: 2^7, … , 2^0

240 = 128 + 64 + 32 + 16 + 0 + 0 + 0 + 0

Binary: 11110000

1. 213

Place value: 2^7 , 2^6 , … , 2^0

213 = 128 + 64 + 0 + 16 + 0 + 4 + 0 + 1

Binary: 11010101