**Subject: PRF192- PFC**

**Workshop 01**

**Class: SE1705**

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**Objectives:**

1. Reviewing for number systems
2. Exploring memory of a C program

**Part 1: Number systems**

**Exercise 1** **(2 marks): Convert decimal numbers to binary ones**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Decimal** | **4-bit Binary** | **Decimal** | **8-bit Binary** | **Decimal** | **16-bit Binary** |
| 9 | 1001 | 7 | 0000 0111 | 255 | 0000 0000 1111 1111 |
| 7 | 0111 | 34 | 0010 0010 | 192 | 0000 0000 1100 0000 |
| 2 | 0010 | 125 | 0111 1101 | 188 | 0000 0000 1011 1100 |
| 15 | 1111 | 157 | 1001 1101 | 312 | 0000 0001 0011 1000 |
| 12 | 1100 | 162 | 1010 0010 | 517 | 0000 0010 0000 0101 |
| 11 | 1011 | 37 | 0010 0101 | 264 | 0000 0001 0000 1000 |
| 6 | 0110 | 66 | 0100 0010 | 543 | 0000 0010 0001 1111 |
| 5 | 0101 | 77 | 0100 1101 | 819 | 0000 0011 0011 0011 |
| 8 | 1000 | 88 | 0101 1000 | 1027 | 0000 0100 0000 0011 |
| 13 | 1101 | 99 | 0110 0011 | 2055 | 0000 1000 0000 0111 |
| 14 | 1110 | 109 | 0110 1101 | 63 | 0000 0000 0011 1111 |

**Exercise 2(2 marks): 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 | 7F | 192 | 0000 0000 1100 0000 | 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 marks): Compute**

(b: binary, q: octal, h: hexadecimal)

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

**1A7Bh + 26FE7h = 28A62h = 0010 1000 1010 0110 0010b**

**1101101101b – 10110111b =1010110110b**

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

**3AB7h – 1FAh = 38BDh = 11100010111101b**

**36Ah – 576q = 1ECh = 111101100b**

**64AEh – 1001101b= 62141 q**

101101111 b

+ 100111011 b

110110001 b

110001101 b

101 1110 1000 b

1011010 b \* 1011b = 11 1101 1110b

1101000b + 2AB h + 345 q = 3F8 h = 1770 q

3AFh / 1Ch = 10 0001 b = 33d

3ACh – 562q = 10 0011 1010b = 570 d

3FFA h / 327q = 100 1100b = 76 d

**Exercise 4 (2 marks)**

1. Show binary formats of 1-byte unsigned numbers:

+ 251: 1111 1011b

+ 163: 1010 0011b

+ 117: 0111 0101b

1. Show binary formats of 2-byte unsigned numbers:

+ 551: 0000 0010 0010 0111b

+ 160: 0000 0000 1010 0000b

+ 443: 0000 0001 1011 1011b

1. Show binary formats of 1-byte signed numbers:

+ -51: 1100 1101b

+ -163: 0101 1101b

+ -117: 1000 1011b

+ 220: 1110 1100b

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

+ 01100011b = 99d

+ 10001111b = 143d

+ 11001010b = 202d

+ 01001100b = 76d

**Reference**

**Add:** https://www.youtube.com/watch?v=zwecauDA\_Fc

**Subtract:** https://www.youtube.com/watch?v=Za09tRRtMcI

**Multiply:** https://www.youtube.com/watch?v=Ai7sKCIZ-TM

**Divide:** https://www.youtube.com/watch?v=BMedqdKqnz4

**Bit operators:** AND, OR, NOT, XOR: https://www.youtube.com/watch?v=y54I4-5bGKI