**Subject: PRF192- PFC**

**Workshop 01**

**Objectives:**

(1) Reviewing for number systems

(2) Exploring memory of a C program

**Recommendations**

Part 1: Students do exercises using notebooks

Part 2: Students develop programs, run them, write down their memory structure to notebooks.

**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 | 9F | 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 = 11101001100b**

**1A7Bh + 26FE7h = 28A62h = 101000101001100010b**

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

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

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

**36Ah – 576q = 1ECh = 111101100b**

**64AEh – 1001101b= 62141q**

101101111 b

+ 100111011 b

110110001 b

110001101b

=10111101000b

1011010 b\* 1011b = 1111011110b

1101000b + 2AB h + 345 q = 3F8h = 1 770q

3AFh / 1Ch = 100001b = 33d

3ACh – 562q = 1000111010b = 570d

3FFA h / 327q = 1001100b = 76d

**Exercise 4 (2 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: :

01100011 b , 10001111 b , 11001010 b , 01001100 b

1. 251 = 1111 1011b

163 = 1010 0011b

117 = 0111 0101b

2. 551 = 0000 0010 0010 0111b

160 = 0000 0000 1010 0000b

443 = 0000 0001 1011 1011b

3. -51 = 0000 1100b

-163 = 0101 1100b

-117 = 0000 1010b

320 = 0100 0000

4. 01100011 b = 99d

10001111 b = 143d

11001010 b = 202d

01001100 b = 76d

**Part 2: Explore memory structure of programs**

**// WS1\_PRF192**

**#include<stdio.h>**

**int n = 23;**

**double x = 23467;**

**char c1 = 'a';**

**int**

**main ()**

**{**

**int m = 6;**

**short s = -1;**

**long L = 4678;**

**float y = 2.35;**

**printf ("Code of main:%u\n", &main);**

**printf ("Variable n, add:%u, memory size:%d\n", &n, sizeof (n));**

**printf ("Variable n, add:%u, memory size:%lf\n", &n, sizeof (x));**

**printf ("Variable n, add:%u, memory size:%c\n", &n, sizeof (c1));**

**printf ("Variable n, add:%u, memory size:%d\n", &n, sizeof (m));**

**printf ("Variable n, add:%u, memory size:%d\n", &n, sizeof (s));**

**printf ("Variable n, add:%u, memory size:%d\n", &n, sizeof (L));**

**printf ("Variable n, add:%u, memory size:%f\n", &n, sizeof (y));**

**return 0;**

**}**