**Subject: PRF192- PFC**

**Workshop 01**

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**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 | C0 |
| 125 | 0111 1101 | 7D | 188 | 0000 0000 1011 1100 | BC |
| 157 | 1001 1101 | 9D | 312 | 0000 0001 0011 1000 | 138 |
| 162 | 1010 0010 | A2 | 517 | 0000 0010 0000 0101 | 205 |
| 37 | 0010 0101 | 25 | 264 | 0000 0001 0000 1000 | 108 |
| 66 | 0100 0010 | 42 | 543 | 0000 0010 0001 1111 | 21F |
| 77 | 0100 1101 | 4D | 819 | 0000 0011 0011 0011 | 333 |
| 88 | 0101 1000 | 58 | 1027 | 0000 0100 0000 0011 | 403 |
| 99 | 0110 0011 | 63 | 2055 | 0000 1000 0000 0111 | 807 |
| 109 | 0110 1101 | 6D | 63 | 0000 0000 0011 1111 | 3F |

**Exercise 3(2 marks): Compute**

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

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

**1A7Bh + 26FE7h =** 28A62 **h =** 1000 1010 0110 0010 **b**

**1101101101b - 10110111b =** 00000010 1011 0110 **b**

**3654q – 337q =3315q =** 0000 0110 1100 1101 **b**

**3AB7h – 1FAh =** 38BD **h =** 0011 1000 1011 1101**b**

**36Ah – 576q =** 1EC **h =** 00000001 1110 1100 **b**

**64AEh – 1001101b=** 62141 **q**

101101111 b

+ 100111011 b

110110001 b

110001101b

10111101000 b

1011010 b\* 1011b =0000 0011 1101 1110 b

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

3AFh / 1Ch =0000 0000 0010 0001 b = 33d

3ACh – 562q = 0000 0010 0011 1010 b = 570d

3FFA h / 327q = 0000 0000 0010 0110 = 38 d

**Exercise 4 (2 marks)**

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

251 : 1111 1011

163: 1010 0011

117: 0111 0101

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

551: 0000 0010 0010 0111

160: 0000 0000 1010 0000

443: 0000 0001 1011 1011

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

-51: 1111 1111 1100 1101

-163: 1111 1111 0101 1101

-117: 1111 1111 1000 1011

320: 0000 0001 0100 0000

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

01100011 b , 10001111 b , 11001010 b , 01001100 b

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01100011 : 99

10001111 : 143 -113

11001010 : 202 -54

01001100 : 76

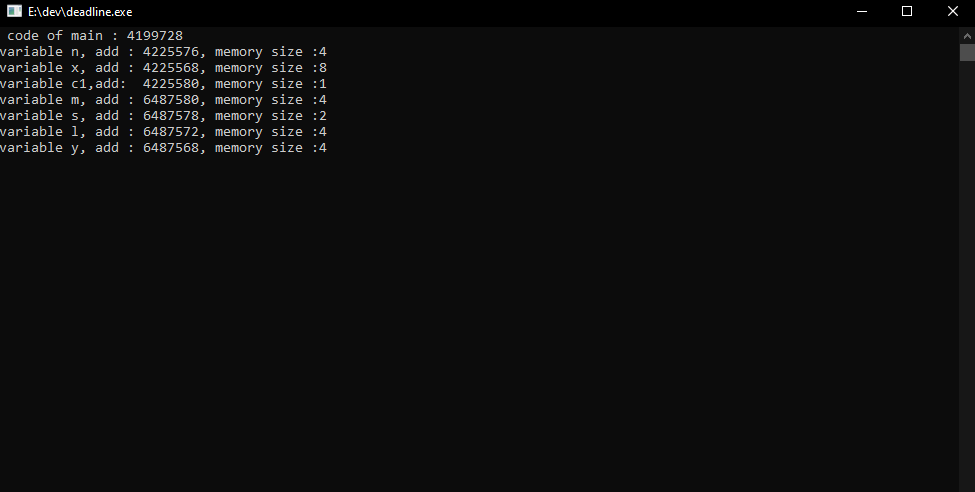
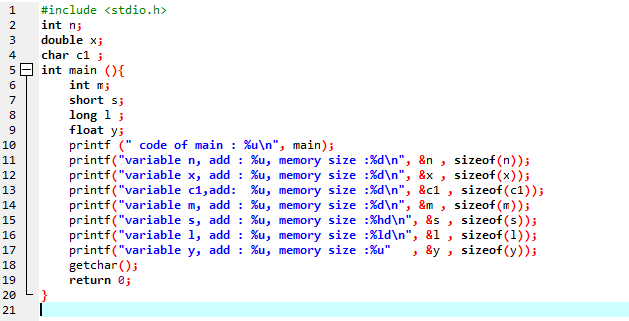
**Part 2: Explore memory structure of programs**

**Sample**

**Complete the code of following program then draw it’s memory structure**

**(2 marks)**





**draw it’s memory structure**

|  |  |
| --- | --- |
| **Address** | **variable** |
| 4225576 | n |
| 4225568 | x |
| 4225580 | c1 |
| 6487580 | m |
| 6487578 | s |
| 6487572 | l |
| 6487568 | y |