**School of Interactive & Digital Media**

**Diploma in Game Development & Technology**

**DM2112 Digital Entertainment Systems**

**Exercise 3:**

**Answer the following questions and submit in a word document.**

**1. What is the largest number a 32-bit system can store? Show your working and assume**

**all numbers are stored as 2’s complement.**

2^(32)-1 =4294967295

4294967295=1111 1111 1111 1111 1111 1111 1111 1111 (1’s compliment)

1111 1111 1111 1111 1111 1111 1111 1111(2’s compliment)

**2. Convert the following non-whole numbers to binary format**

**a. 0.01**

|  |  |
| --- | --- |
| Divide 2 | Carry |
| 0.02 | 0 |
| 0.04 | 0 |
| 0.08 | 0 |
| 0.16 | 0 |
| 0.32 | 0 |
| 0.64 | 0 |
| 1.28 | 1 |

Ans:0.0000001

**b. 17.5555**

|  |  |  |  |
| --- | --- | --- | --- |
| Divide 2 | Remainder | Multiply 2 | Carry |
| 8 | 1 | 0.111 | 1 |
| 4 | 0 | 0.222 | 0 |
| 2 | 0 | 0.444 | 0 |
| 1 | 0 | 0.888 | 0 |
| 0 | 1 | 0.776 | 1 |
|  |  | 0.552 | 1 |

Ans:10001.100011

**c. 0.625**

|  |  |
| --- | --- |
| Multiply 2 | Carry |
| 0.25 | 1 |
| 0.50 | 0 |
| 0.0 | 1 |

Ans:0.101

**d. 0.125**

|  |  |
| --- | --- |
| Multiply 2 | Carry |
| 0.25 | 0 |
| 0.50 | 0 |
| 0.0 | 1 |

Ans:0.001

**3. Convert the following decimals in the entire following format, excess notation, 1s’**

**complement and 2’s complement. You may assume 8 bits.**

**a. 0**

|  |  |  |
| --- | --- | --- |
| *Excess Notation* | *1’s Complement* | *2’s Complement* |
| 1000 0000 | 0000 0000 | 0000 0000 |

**b. 127**

|  |  |  |
| --- | --- | --- |
| Excess Notation | 1’s Complement | 2’s Complement |
| 1111 1111 | 0111 1111 | 0111 1111 |

**c. -127**

|  |  |  |
| --- | --- | --- |
| Excess Notation | 1’s Complement | 2’s Complement |
| 0000 0001 | 1000 0000 | 1000 0001 |

**d. -64**

|  |  |  |
| --- | --- | --- |
| Excess Notation | 1’s Complement | 2’s Complement |
| 0100 0000 | 1011 1111 | 1100 0000 |

**e. -99**

|  |  |  |
| --- | --- | --- |
| Excess Notation | 1’s Complement | 2’s Complement |
| 0001 1101 | 1001 1100 | 1001 1101 |

**4. Perform the following arithmetic operation, assuming the numbers are in 16-bit 2’s**

**complement binary representation**

**a. –(0x7FF8) – (0x46)**

-(7\*16^3 + 15\*16^2 + 15\*16^1 + 8\*16^0) – (4\*16^1 + 6\*16^0)

= -32760 – 70=-32830

Ans:-32830

**5. Convert and normalize the following real numbers to floating point numbers. You may**

**assume 8 significant figures in endless cases.**

**a. 0.325**

Ans:3.25 x 10^-1

**b. 0.375**

Ans:3.75 x 10^-1

**c. 0.815**

Ans:8.15 x 10^-1

**d. 0.322**

Ans:3.22 x 10^-1

**e. 0.777**

Ans:7.77 x 10^-1

