Quiz 3 v1 –Error Detection Techniques & Float Add **Duration: 20 minutes**

Q.1. Show the steps followed when **adding** 2.75 and -5.375 using the following floating-point 8-bit representation: 1 bit for sign, 3-bit exponent in biases representation with bias = 3 and 4-bit Mantissa. Convert the numbers to binary and hex first and then add them showing the binary, hex and decimal values of the results. Do this question on the back if no space. Comment on the accuracy of the result and reason for it if it is not accurate. **[30 marks]**

29/100

check back page

① convert to FLP:

$2.75 \xrightarrow{\text{①bicimal}} 10.11 \times 2^0 \xrightarrow{\text{②normalize}} 1.011 \times 2^1 \longrightarrow$ 1bit | 3bit | 4bit $\longrightarrow 0 \mid 100 \mid 0110 \longrightarrow 46_{16}$

sig

exp = 1+3 = 4

2 = 10

0.75 × 2 = 0.5 → 1

0.5 × 2 = 0 → 1

$-5.375 \xrightarrow{\text{①bicimal}} -101.011 \times 2^0 \xrightarrow{\text{②normalize}} -1.01011 \times 2^2 \longrightarrow 1 \mid 101 \mid 0101 \longrightarrow 05_{16}$

sig

exp = 2+3 = 5

↓

result has a loss in accuracy since we lost a bit

-5 = -101

0.375 × 2 = 0.75 → 0

0.75 × 2 = 0.5 → 1

0.5 × 2 = 0 → 1

② rules: ① if one of the FLPs are -ve → subtraction

bigger num − smaller num

② if both FLP's are +ve → addition

bigger num + smaller num

in this case we have 1 -ve num → subtraction

-1.01011×2^2 , 0.1011×2^2 → adjust to big exp

ignoring 1 is bigger than so -1.01011×2^0 goes first

-1.010×2^1

-10.1×2^0

(-2.5)

-1.0101×2^2

-0.1011×2^2

-0.1010×2^2

0−1 = 1' , 1−0 = 1, 1−1 = 0, 0−0 = 0

−10.1

1+3 = 4

normalize → $-1.010 \times 2^1 \longrightarrow 1 \mid 100 \mid 0100 \Rightarrow C4_{16}$

loss in accuracy since we lost a bit in one of the FLP's. ✓

Q.2. A computer program received the hex message FEACBA9B from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message be in Hex (ACK=06_{16}, NAK=15_{16}). What is the original message assuming the message is correct? Show all carries. **[20 marks]**

A=10
B=11
C=12
D=13

(1) section into even bits

A=10 E=14
B=11 F=15
C=12
D=13

```
2 2
  FE
  AC
+ BA
  9B
-----
1 1 ff
  +
    2
-----
  0 1
  + 1
-----
  0 2
```

FD ≠ all 0's

0000 0010 → complement → F D → 1111 1101 ≠ all 0's

therefore there is an error.

message sent back is

NAK = 15_{16}

Original message: FE ACBA

Q.3. A computer program received the binary message 1000100101 from another computer using the Cyclic Redundancy Check method with a polynomial generator of x^4+x^3+x+1. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver send to the sender for this message in Hex (ACK=06_{16}, NACK=15_{16}). Also give the original message that the sender wanted to send. 29 **[30 marks]**

① x^4+x^3+x+1

11011 → poly

```
          1 1 1 0 1 1
      ┌──────────────
11011 | 1 0 0 0 1 0 0 1 0 1
      ⊕ 1 1 0 1 1
        ─────────
        0 1 0 1 0 0
      ⊕   1 1 0 1 1
        ─────────
        0 1 1 1 1 0
      ⊕     1 1 0 1 1
        ─────────
        0 0 1 0 1 1
      ⊕       0 0 0 0 0
        ─────────
        0 1 0 1 1 0
      ⊕         1 1 0 1 1
        ─────────
        0 1 1 0 1 1
      ⊕           1 1 0 1 1
        ─────────
        0 0 0 0 0
```

remainder = all 0's

Therefore message is correct

original message : 100010

message sent back in hex : 06_{16} (ACK)

Q.4. A sender sends the message "MAJ" to a receiver using odd block parity check. Write down, in **Hex** format, the sequence of data sent to the user. **Show the parity bits and parity byte in the table below after you work the solution.** [20 marks]

Character (Hex ASCII)	Add 8th bit here	Binary (7 bits ASCII)	Message sent in Hex
M (4D)	1	100 1101	CD16
A (41)	1	100 0001	C116
J (4B)	1	100 1011	CB16
parity byte	0	011 1000	3816

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parity bit odd

4D (1. 100 1101) → CD_{16}

41 (1 100 0001) → $C1_{16}$

4B (1. 100 1011) → CB_{16}

parity byte (0 011 1000) → 38_{16}

Quiz 3 v1 –Error Detection Techniques **Duration: 15 minutes**

Q.1. A computer program received the hex message AB3CFE19 from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message be in Hex (ACK=06_{16}, NAK=15_{16}). [7 marks]

①

```
  ① 2
    AB
    3C
    FE
+   19
-------
    FE
+ ↓  1
-------
    FF16
```

1111	1111
0000	0000

→ checksum = 0

message is correct since checksum = 0

the message reciever sends to sender in hex is 06_{16} (ACK).

sent message = FD + 2 = FF

$AB3CFE19FF_{16}$

Q.2. A computer program received the binary message 100101100 from another computer using the Cyclic Redundancy Check method with a polynomial generator of x^3+x+1. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message in Hex (ACK=06_{16}, NAK=15_{16}). [7 marks]

x^3+x+1

①

x^3+x+1 → 4 bits

1 0 1 1 → poly

```
          1 0 1 0 1 0
      ┌─────────────
1011  | 1 0 0 1 0 1 1 0 0
      ⊕ 1 0 1 1
        ---------
        0 0 1 0 0
      ⊕ 0 0 0 0
        ---------
        0 1 0 0 1
      ⊕ 1 0 1 1
        ---------
        0 0 1 0 1
      ⊕ 0 0 0 0
        ---------
        0 1 0 1 0
      ⊕ 1 0 1 1
        ---------
        0 0 0 1 0
      ⊕ 0 0 0 0
        ---------
        0 0 1 0   → ≠ all 0's
```

therefore message is not correct

reciever will send the sender 15_{16} in hex. (NAK).

Q.3. A sender sends the message "UAE" to a receiver using odd block parity check. Write down, in Hex format, the sequence of data sent to the user. Show the parity bits and parity byte in the table below after you work the solution. **[6 marks]**

Character (Hex ASCII)	8th bit (parity bit)	Binary (7 bits ASCII)	Hex
U (55)	1	101 0101	D 5
A (41)	1	100 0001	C 1
E (45)	0	100 0101	4 5
Parity byte	1	0101110	A E

Message sent

message sent is D5C145AE

55 (1 | 101 0101) → $D5_{16}$

41 (1 | 100 0001) → $C1_{16}$

45 (0 | 100 0101) → 45_{16}

parity byte (1 | 010 1110) → AE_{16}

message sent: $D5C145AE_{16}$

Q.1. A computer program received the hex message CD7BA611 from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver send to the sender for this message in Hex and the original message that the sender wanted to send. **[35 marks]**

①

```
  1
  CD
  7B
+ A6
  11
-----
  1 1 FF
+     1
-----
    0 0
+     1
-----
    0 1
```

0000 0001 → complement → 1111 1110 ≠ all 0's

Therefore, the message is not correct.
The answer the reciever will send to the sender in hex is 15_{16}.
The original message is:

CD7BA6

Q.2. A computer program received the binary message 1101010101 from another computer using the Cyclic Redundancy Check method with a polynomial generator of 1011. Check whether this message is correct or not showing all details that the receiver will do and send back in hex. What is the original message that the sender wanted to send provided that the received message is assumed correct? **[35 marks]**

①

```
          1 1 1 1 0 1 1
      ____________________
1011 | 1 1 0 1 0 1 0 1 0 1
     ⊕ 1 0 1 1
       -------
       0 1 1 0 0
     ⊕   1 0 1 1
       -------
       0 1 1 1 1
     ⊕     1 0 1 1
       -------
       0 1 0 0 0
     ⊕   1 0 1 1
       -------
       0 0 1 1 1
     ⊕     1 0 1 1
       -------
       0 0 0 0 0
```

→ = all 0's → no error

The message is correct and the reciever will send 06_{16} back to the sender.

Original message: 1101010

Q.3. A computer sends the message "Jam" to another computer using **even** parity byte technique. Write down, in Hex format, the sequence of data sent to the user. Show all workings. 30/ **[30 marks]**

Character (Hex)	Even Parity Bits	Binary	Hex (sent message)
J (4A)	1	100 1010	CA
a (61)	1	110 0001	E1
m (6D)	1	110 1101	ED
Parity Byte	1	100 0110	C6

4A (1 | 100 1010) → CA_{16}

61 (1 | 110 0001) → $E1_{16}$

6D (1 | 110 1101) → ED_{16}

Parity byte (1 | 100 0110) → $C6_{16}$

Quiz 3 v3 –Error Detection Techniques & Float Add Duration: 20 minutes

Q.1. Show the steps followed when adding -1.75 and +3.875 using the following floating-point representation: 1 bit for sign, 3-bit exponent in biases representation with bias = 3 and 4-bit Mantissa. Convert the numbers to binary and hex first and then add them showing the binary, hex and decimal values of the results. Do this question on the back if no space. Comment on the accuracy of the result and reason for it if it is not accurate. **[30 marks]**

1 bit	3 bit	4 bit
sign	exp	mant

bias = 3

(1) -1.75 ① bicimal → -1.11×2^0 ② normalize ✓ → -1.11×2^0 → 1 | 011 | 1100 → BC_{16}

$-1 = -1$

exp = 0+3 = 3 = 011

sig = 1100

0.75

X 2

0.5 → 1

X 2

0 → 1

3.875 ① bicimal → 11.111×2^0 ② normalize → 1.1111×2^1 → 0 | 100 | 1111 → 4F

3 = 11

exp = 1+3 = 4

sig = 1111

0.875

X 2

0.75 → 1

X 2

0.5 → 1

X 2

0 → loop

subtraction

(2) adjust exp: -0.111×2^1 , 1.1111×2^1

$-2 = -10 = -2.000\ldots$ 1.1111×2^1

0.001

X 2

0.002 → 0

X 2

0.004 → 0

X 2

0.008 → 0

-10.001×2^0

$- \quad 0.1110 \times 2^1$

$- \quad 1.0001 \times 2^1$ ✓ normalize

1+3 = 4

1 | 100 | 0001 = $C1_{16}$

Q.2. A computer program received the hex message 6B9D3CBB from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message be in Hex (ACK=06_{16}, NAK=15_{16}). What is the original message assuming the message is correct? **[20 marks]**

1 2

① 6B
9D
3C
\+ BB
---
1 1 ff
\+ 1
---
0 0
\+ 1
---
0 1

✓ ↓

0000 0001

1111 1110 ≠ all 0's

f E

The message is not correct.
The reciever will send 15_{16} to the sender.

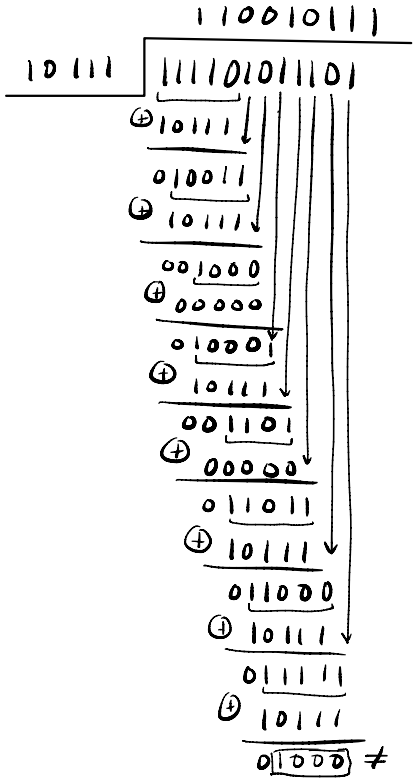
Original message: 6B9D3C

Q.3. A computer program received the binary message 11110101110_b from another computer using the Cyclic Redundancy Check method with a polynomial generator of x^4+x^2+x+1. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message in Hex (ACK=06_{16}, NAK=15_{16}). Also give the original message that the sender wanted to send. **[30 marks]**

20/

(1) $x^4+x^2+x+1 \longrightarrow$ 5 bits

10111 → poly



original message: 11110101

Therefore the message is not correct

the reciever will send the sender 15_{16} in hex.

Q.4. A sender sends the ~~message~~ "ZAY" to a receiver using **even** block parity check. Write down, in **Hex** format, the sequence of data sent to the user. Show the parity bits and parity byte in the table below after you work the solution. **[20 marks]**

Character (Hex ASCII)	Add 8th bit here	Binary (7 bits ASCII)	Message sent in Hex
Z(4D)	0	100 1101	$4D_{16}$
A (42)	0	100 0010	42_{16}
Y (5A)	0	101 1010	$5A_{16}$
parity byte	0	101 0101	55_{16}

4D (0 | 100 1101) → $4D_{16}$

42 (0 | 100 0010) → 42_{16}

5A (0 | 101 1010) → $5A_{16}$

parity byte (0 | 101 0101) → 55_{16}

Quiz 3 v1 –Error Detection Techniques & Float Add Duration: 20 minutes

Q.1. Show the steps followed when **adding** 2.75 and -5.375 using the following floating-point 8-bit representation: 1 bit for sign, 3-bit exponent in biases representation with bias = 3 and 4-bit Mantissa. Convert the numbers to binary and hex first and then add them showing the binary, hex and decimal values of the results. Do this question on the back if no space. Comment on the accuracy of the result and reason for it if it is not accurate. **[30 marks]**

check back page

1 bit | 3 bit | 4 bit
sign | exp | mantissa

(1) 2.75 —①bicimal→ 10.11 x 2^0 —②normalize→ 1.011 x 2^1 → | 0 | 100 | 0110 | → 46_{16}

exp = 3+1 = 4
sig = 0110
sign = 0

2 = 10

0.75
x 2
0.5 → 1
x 2
0 → 1

-5.375 —①bicimal→ -101.011 x 2^0 —②normalize→ -1.0101 x 2^2 → | 1 | 101 | 0101 | → 05_{16}

loss of accuracy

exp = 2+3 = 5
sig = 0101 → loss in accuracy since last bit (1) is removed so mantissa can fit 4 bits
sign = 1

-5 = -101

0.375
x 2
0.75 → 0
x2
0.5 → 1
x 2
0 → 1

(2) adjust exp then add floats

-1.0101 x 2^2 , 0.1011 x 2^2

```
-1.1010101  x 2^2
 0.1011     x 2^2
-------------------
-0.1010     x 2^2   normalize → -1.0100 x 2^1 → | 1 | 100 | 0100 |
```

1+3 = 4

decimal?
-10.1 x 2^0
-2.5

1 x 2^-1 = 0.5

$C4_{16}$

Q.2. A computer program received the hex message FEACBA9B from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message be in Hex (ACK=06_{16}, NAK=15_{16}). What is the original message assuming the message is correct? Show all carries. **[20 marks]**

A=10
B=11
C=12
D=13

(1)

(2) 2

FE_{16}
AC_{16}
\+ BA_{16}
$9B_{16}$

(1) 1 f f
\+ 2
0 1
\+ 1
0 2 = 00000010 → complement → 1111 1101 = FD_{16} ≠ all 0's

0000 0010

this means the message is not correct since the checksum result didn't give us all 0's.
The answer that the reciever will send to the sender is 15_{16} (NAK).
The original message is: FEACBA

Q.3. A computer program received the binary message 1000100101 from another computer using the Cyclic Redundancy Check method with a polynomial generator of x^4+x^3+x+1. (1) Check whether (2) this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver send to the sender for this message in Hex (ACK=06_{16}, NACK=15_{16}). Also give (3) the original message that the sender wanted to send. **[30 marks]**

5 - 1 = 4 bits removed

(1) $x^4 + x^3 + x + 1$ → 5 bits

11011 → poly

```
      11101
  11011|10001001 01
     ⊕ 11011
       01010 0
     ⊕  11011
        01111 0
      ⊕ 11011
         00101 1
       ⊕ 00000
          01011 0
        ⊕ 11011
           01101 1
         ⊕ 11011
            00000
```

00000 → means that theirs no error, and that the message is correct.

(1) The reciever will send the message 06_{16} (ACK) to the sender.

(3) The original message: 100010

Q.4. A sender sends the message "MAJ" to a receiver using odd block parity check. Write down, in **Hex** format, the sequence of data sent to the user. **Show the parity bits and parity byte** in the table below after you work the solution. **[20 marks]**

Character (Hex ASCII)	Add 8th bit here	Binary (7 bits ASCII)	Message sent in Hex
M (4D)	1	100 1101	CD_{16}
A (41)	1	100 0001	$C1_{16}$
J (4B)	1	100 1011	CB_{16}
parity byte	0	011 1000	38_{16}

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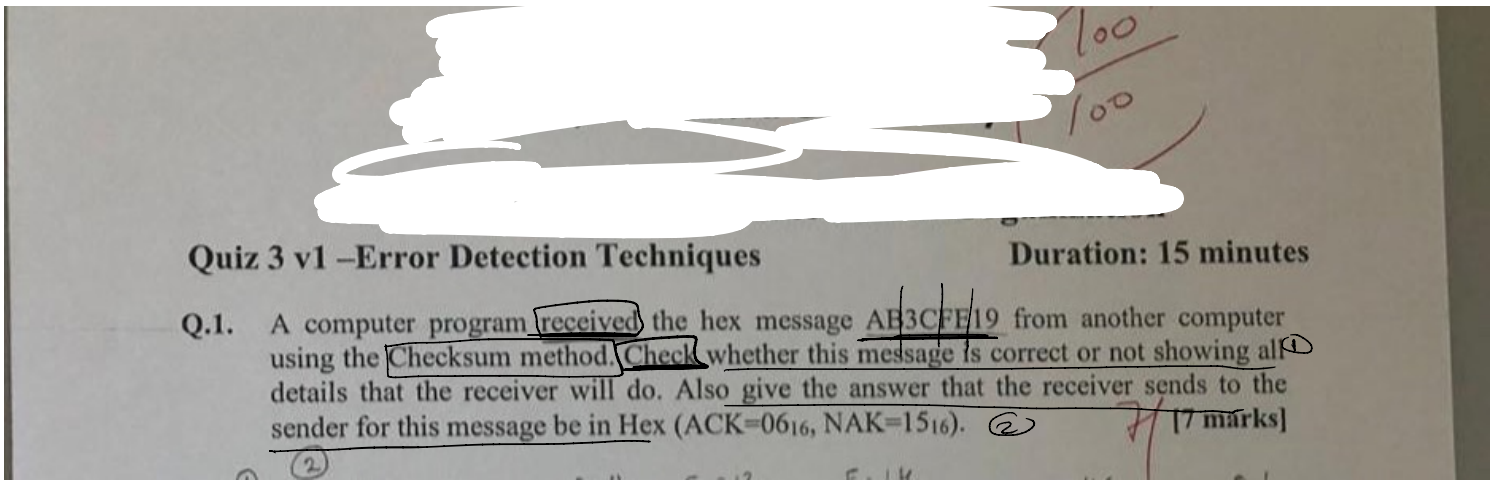
4D (1 | 100 1101) → CD_{16}

41 (1 | 100 0001) → $C1_{16}$

4B (1 | 100 1011) → CB_{16}

parity byte (0 | 011 1000) → 38_{16}



Quiz 3 v1 –Error Detection Techniques **Duration: 15 minutes**

Q.1. A computer program received the hex message AB3CFE19 from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message be in Hex (ACK=06_{16}, NAK=15_{16}). **[7 marks]**

```
  AB16
  3C16
+ FE16
  1916
------
  FE
+  1
------
  FF16
  ✓  ↓
 1111 1111
 0000 0000  = no errors
```

① The message is correct since the checksum result gave us all 0's indicating theres no error.

② The reciever will send 06_{16} (ACK) to the sender.

③ original message: ? AB3CFE19 ✓

```
  AB
+ 3C
  FE
------
  E5
+  1
------
  E6
  ↙  ↓
 1110 0110
 0001 1001 = 19 ✓
```

Q.2. A computer program received the binary message 100101100 from another computer using the Cyclic Redundancy Check method with a polynomial generator of x^3+x+1. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message in Hex (ACK=06_{16}, NAK=15_{16}). [7 marks]

original message: 4-1 = 3 bits removed

① x^3+x+1 → 4 bits

1011 → poly

4−1 = ③

```
          101010
     ____________
1011 | 100101100
     ⊕ 1011
       -----
       00100
       ⊕ 0000
       -----
       01001
       ⊕ 1011
       -----
       00101
       ⊕ 0000
       -----
       01010
       ⊕ 1011
       -----
       00010
       ⊕ 0000
       -----
       00010   ≠ all 0's
```

Therefore the message is incorrect since the remainder wasn't = to all 0's.

The answer that the reciever will send to the user is 15_{16} (NAK).

The original message: 100101.

Q.3. A sender sends the message "UAE" to a receiver using odd block parity check. Write down, in Hex format, the sequence of data sent to the user. Show the parity bits and parity byte in the table below after you work the solution. [6 marks]

Character (Hex ASCII)	8th bit (parity bit)	Binary (7 bits ASCII)	Hex
U (55)	1	101 0101	D5
A (41)	1	100 0001	C1
E (45)	0	100 0101	45
Parity byte	1	010 1110	AE

Message sent

message sent is D5C145AE

55 (1 | 101 0101) → $D5_{16}$

41 (1 | 100 0001) → $C1_{16}$

45 (0 | 100 0101) → 45_{16}

parity byte (1 | 010 1110) → AE_{16}

message sent.

Q.1. A computer program **received** the hex message CD7BA611 from another computer using the **Checksum** method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver send to the sender for this message in Hex and the original message that the sender wanted to send. **[35 marks]**

CD_{16}
$7B_{16}$
$A6_{16}$
11_{16}
FF
$+\ 1$
00
$+\ 1$
01

0000 0001

1111 1110 = FE_{16} ≠ all 0's

The message is incorrect since checksum result is not = to all 0's.

The reciever will send 15_{16} (NAK) to the sender to ask for a retransmission.

The original message: CD7BA6

Q.2. A computer program **received** the binary message **1101010101** from another computer using the Cyclic Redundancy Check method with a polynomial generator of 1011. Check whether this message is correct or not showing all details that the receiver will do and send back in hex. What is the original message that the sender wanted to send provided that the received message is assumed correct? **[35 marks]**

4-1 = 3 bits removed → original message

1011 → poly 4bits

```
        1111011
    ____________
1011 | 1101010101
     ⊕ 1011
       01100
     ⊕ 1011
       01111
     ⊕ 1011
       01000
     ⊕ 1011
       00111
     ⊕ 0000
       01110
     ⊕ 1011
       01011
     ⊕ 1011
       0000
```

0000 = no error

The message is correct. The reciever will send 06_{16} (ACK) back to the sender.

The original message: 1101010

Q.3. A computer sends the message "Jam" to another computer using even parity byte technique. Write down, in Hex format, the sequence of data sent to the user. Show all workings. 30 **[30 marks]**

Character (Hex)	Even Parity Bits	Binary	Hex (sent message)
J (4A)	1	100 1010	CA_{16}
a (61)	1	110 0001	$E1_{16}$
m (6D)	1	110 1101	ED_{16}
Parity Byte	1	100 0110	$C6_{16}$

4A (1	100 1010)	$\rightarrow CA_{16}$
61 (1	110 0001)	$\rightarrow E1_{16}$
6D (1	110 1101)	$\rightarrow ED_{16}$
Parity byte (1	100 0110)	$\rightarrow C6_{16}$

Quiz 3 v3 –Error Detection Techniques & Float Add Duration: 20 minutes

Q.1. Show the steps followed when adding -1.75 and +3.875 using the following floating-point representation: 1 bit for sign, 3-bit exponent in biases representation with bias = 3 and 4-bit Mantissa. Convert the numbers to binary and hex first and then add them showing the binary, hex and decimal values of the results. Do this question on the back if no space. Comment on the accuracy of the result and reason for it if it is not accurate. **[30 marks]**

① | 1bit (sign) | 3bit (exp) | 4bit (mant) | bias = 3

$-1.75 \xrightarrow{\text{①bicimal}} -1.11 \times 2^0 \xrightarrow{\text{②normalize}} -1.11 \times 2^0 \longrightarrow 1\,|\,011\,|\,1100 \longrightarrow BC_{16}$

0+3 = 3 → biased exp

$-1 = -1.11$

0.75
× 2
0.5 → 1
× 2
0 → 1

$3.875 \xrightarrow{\text{①bicimal}} 011.111 \times 2^0 \xrightarrow{\text{②normalize}} 1.1111 \times 2^1 \longrightarrow 0\,|\,100\,|\,1111 \longrightarrow 4F_{16}$

1+3 = 4 → biased exp

+3 = +011

0.875
× 2
0.75 → 1
× 2
0.5 → 1
× 2
0 → 1

② 1.1111×2^1 , -0.111×2^1 less accurate

$$\begin{array}{r} 1.1111 \times 2^1 \\ -\ 0.1110 \times 2^1 \\ \hline -\ 1.0001 \times 2^1 \end{array}$$

normalize ✓

$1\,|\,100\,|\,0001 \longrightarrow C1_{16}$ ✓

1+3=4

-10.0×2^0

$0 \times 2^{-1} = 0$

-2.0

Q.2. A computer program received the hex message 6B9D3CBB from another computer using the Checksum method. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message be in Hex (ACK=06_{16}, NAK=15_{16}). What is the original message assuming the message is correct? [20 marks]

① ②

$6B_{16}$
$9D_{16}$
$3C_{16}$ +
BB_{16}

① FF
+ 1
00
+ 1
01

0000 0001

1111 1110 = $FE_{16} \neq$ all 0's

so, the message is incorrect. The reciever will send to the sender 15_{16} (NAK) since the checksum result wasn't equal to all 0's.

The original message: 6B9D3C

Q.3. A computer program received the binary message 11110101 1101 from another computer using the Cyclic Redundancy Check method with a polynomial generator of x^4+x^2+x+1. Check whether this message is correct or not showing all details that the receiver will do. Also give the answer that the receiver sends to the sender for this message in Hex (ACK=06_{16}, NAK=15_{16}). Also give the original message that the sender wanted to send. **[30 marks]**

5-1 = 4 bits removed

① $x^4 + x^2 + x + 1$ → 5 bits

1 0 1 1 1 → poly

```
        1 1
  10111 ) 1 1 1 1 0 1 0 1 1 1 0 1
        ⊕ 1 0 1 1 1
          0 1 0 0 1 1
```

15_{16}