**Assignment 1**

**Question 1:**

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Operation | Result | Remainder |
| 1 | 2347/2 | 1173 | 1 |
| 2 | 1173/2 | 586 | 1 |
| 3 | 586/2 | 293 | 0 |
| 4 | 293/2 | 146 | 1 |
| 5 | 146/2 | 73 | 0 |
| 6 | 73/2 | 36 | 1 |
| 7 | 36/2 | 18 | 0 |
| 8 | 18/2 | 9 | 0 |
| 9 | 9/2 | 4 | 1 |
| 10 | 4/2 | 2 | 0 |
| 11 | 2/2 | 1 | 0 |
| 12 | 1/2 | 0 | 1 |

﻿

234710 = (100100101011)2

b)

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Operation | Result | Remainder |
| 1 | 98721/8 | 12340 | 1 |
| 2 | 12340/8 | 1542 | 4 |
| 3 | 1542/8 | 192 | 6 |
| 4 | 192/8 | 24 | 0 |
| 5 | 24/8 | 3 | 0 |
| 6 | 3/8 | 0 | 3 |

9872110 = 3006418

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Operation | Result | Remainder |
| 1 | 582/16 | 36 | 6 |
| 2 | 36/16 | 2 | 4 |
| 3 | 2/16 | 0 | 2 |

58210 = 24616

c)

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Operation | Result | Remainder |
| 1 | 13/2 | 6 | 1 |
| 2 | 6/2 | 3 | 0 |
| 3 | 3/2 | 1 | 1 |
| 4 | 1/2 | 0 | 1 |

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Operation | Result | Integer Part |
| 1 | 0.625 2 | 1.25 | 1 |
| 2 | 0.25 2 | 0.5 | 0 |
| 3 | 0.5 2 | 1 | 1 |

13.62510 = 1101.1012

**Question 2:**

3510 = 01000112

4010 = 01010002

34 + 40 in 2's complement

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| + | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 1 | 0 | 1 | 1 |

There is an overflow as the sign is changed, so the result is wrong.

b)

35-40:

3510 = 01000112 (7 bits)

-40 in 2's complement.

4010 = 01010002

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | Inverse 0to 1 and visversa |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | +1 |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | -40 in 2's complement |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| + | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
|  | 1 | 1 | 1 | 1 | 0 | 1 | 1 |

**There is no overflow.**

35-40 = (1111011) 2's complement.

c)

from previous question we have -40 in 2' complement.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 35 in binary 7 bits |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | Inverse 0to 1 and vise-versa |
| 1 | 0 | 1 | 1 | 1 | 0 | 1 | +1 |
|  |  |  |  |  |  |  | -35 in 2's complement |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Cout 1 | Cin 0 |  | Cin 1 |  |  |  |  |
|  | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| + | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |

-35-40 = (0110001) 2's complement. The sigh is changed and The correct binary result for -35-40 cannot be correct in 7 bits it will in in 8 bits. Thus, and overflow is happened.

**Question 3:**

|  |  |
| --- | --- |
|  |  |
|  | DeMorgans Law |
|  | DeMorgans Law |
|  | A'' = A Involution law |
|  | Involution law |
|  | Inverse law |

|  |  |
| --- | --- |
|  |  |
|  | Distribution law |
|  | Distribution law |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Question 4**

﻿F = xy + xy’ + y’z

Truth table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **x** | **y** | **y'** | **z** | **xy** | **xy'** | **y'z** | **F** |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |

﻿F = bc + a’c

Truth table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **a** | a' | b | c | c' | bc | a'c' | F |
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |

**Question 5**

﻿F = xy + x’y’ + y’z

a)

Diagram

Description automatically generated

b)

Diagram

Description automatically generated

c)

Diagram

Description automatically generated

Question 6

a)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Binary code for | | |  |  | Segments | | | | | | |
|  | D3 | D2 | D1 | D0 |  | a | b | c | d | e | f | g |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| 3 | 0 | 0 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| 4 | 0 | 1 | 0 | 0 | 4 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 5 | 0 | 1 | 0 | 1 | 5 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 6 | 0 | 1 | 1 | 0 | 6 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 7 | 0 | 1 | 1 | 1 | 7 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 8 | 1 | 0 | 0 | 0 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | 1 | 0 | 0 | 1 | 9 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |

b)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Binary code for | | |  |  | Segments | |
|  | D3 | D2 | D1 | D0 | A picture containing text  Description automatically generated | g | g |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | D3+D2+D1+D0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | D3+D2+D1+D0' |
| 2 | 0 | 0 | 1 | 0 | 2 | 1 | 1 |
| 3 | 0 | 0 | 1 | 1 | 3 | 1 | 1 |
| 4 | 0 | 1 | 0 | 0 | 4 | 1 | 1 |
| 5 | 0 | 1 | 0 | 1 | 5 | 1 | 1 |
| 6 | 0 | 1 | 1 | 0 | 6 | 1 | 1 |
| 7 | 0 | 1 | 1 | 1 | 7 | 0 | D3+D2'+D1'+D0' |
| 8 | 1 | 0 | 0 | 0 | 8 | 1 | 1 |
| 9 | 1 | 0 | 0 | 1 | 9 | 1 | 1 |

Since we have less 0's than 1's were going to use product of sum to get the equivalent logic circuit.

So, the logic circuit is as follow:

Diagram

Description automatically generated