BLG231E – Assignment 1

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Part 1

1.

a.

i)

B = 0010 0110 + 1 = 0*2^0 + 1*2^1 + 1*2^2 + 0*2^3 + 0*2^4 + 1*2^5* 0*2^6 + 1 = -39

max signed 8-bit positive integer is 127.

A – (-39) <= 127

largest decimal value of **A = 88**

ii)

B = 0010 0110 + 1 = 0*2^0 + 1*2^1 + 1*2^2 + 0*2^3 + 0*2^4 + 1*2^5* 0*2^6 + 1 = -39

min signed 8-bit integer is -128.

A – B >= -128

smallest decimal value of **A = -128**

b.

decimal value of A = 88

binary representation of A = 0101 1000

A – B

0101 1000		**0**101 1000
- **1**101 1001	(2's complement)	+ **0**010 0111
		0111 1111

(bold digits give the signs)

there is no overflow, result is valid.

c.

i)

max unsigned 8-bit positive integer is 255.

A – B = C

B = 1101 1001 = 1*2^0 + 0*2^1 + 0*2^2 + 1*2^3 + 1*2^4 + 0*2^5 + 1*2^6 + 1*2^7 = 217

C <= 1111 1111 and A <= 1111 1111

largest unsigned 8-bit binary value of **A = 1111 1111**

ii)

min unsigned 8-bit binary number is 0000 0000.

A – B = C

B = 1101 1001 = 1*2^0 + 0*2^1 + 0*2^2 + 1*2^3 + 1*2^4 + 0*2^5 + 1*2^6 + 1*2^7 = 217

0000 0000 <= C and 0000 0000 <= A

A – B <= 0000 0000

smallest unsigned 8-bit binary value of **A = B = 1101 1001**

2.

a.

i)

A = **1**011 1100 (bold digit gives the sign, negative)

1011 1100 (2's complement)

0100 0011 (add 1)

0100 0100 68

so, decimal value of A = -68

max signed 8-bit integer is 127.

A + B <= 127

largest signed 8-bit decimal value of **B = 127**

ii)

decimal value of A = -68

min signed 8-bit integer is -128.

A + B >= -128

A + (-68) >= -128

smallest signed 8-bit decimal value of **B = -60**

b.

smallest decimal value of B is -60

binary representation of B = **1**100 0100 (bold digit give the sign, negative)

A = **1**011 1100

1011 1100

+ 1100 0100

1**1**000 0000 (9th digit is ignored; bold digit gives the sign, negative)

Part 2

3.

a.

E(a, b, c) = ab’c + abc’ + abc + a’bc

abc + abc’ + **ab’c** + a’bc	(commutative)
ab(c + c’) + ab’c + a’bc	(distributivity)
ab**(1)** + ab’c + a’bc	(inverse)
ab + ab’c + a’bc	(identity)
ab + ab’c + a’bc **+ abc**	(idempotence)
ab + ab’c + **abc** + **a’bc**	(commutative)
ab + a**cb’** + a**cb** + a’bc	(commutative)
ab + **ac(b’ + b)** + a’bc	(distributivity)
ab + ac**(b + b’)** + a’bc	(commutative)
ab + ac**(1)** + a’bc	(inverse)
ab + **ac** + a’bc	(identity)
ab + ac + a’bc **+ abc**	(idempotence)
ab + ac + **bc**a’ + **bc**a	(commutative)

ab + ac + **bc(a' + a)** (distributivity)

ab + ac + bc**(a + a')** (commutative)

ab + ac + bc**(1)** (inverse)

ab + ac + **bc** (identity) **(final expression)**

b.

E(a, b, c, d) = a'bd' + bcd + abc' + ab'd + bc'd' + ad + a'bc

a'bd' + **bcd** + abc' + ab'd + bc'd' + **ad** + **a'bc** (consensus theorem respect to a)

a'bd' + abc' + ab'd + bc'd' + ad + a'bc (consensus term is removed)

a'bd' + abc' + ab'd + **bc'd'** + ad + **a'bc** (consensus theorem respect to c)

abc' + ab'd + bc'd' + ad + a'bc (consensus term is removed)

abc' + ab'd + **bc'd'** + **ad** + a'bc (consensus theorem respect to d)

ab'd + bc'd' + ad + a'bc (consensus term is removed)

ab'd + bc'd' + **ad** + a'bc (absorption)

bc'd' + ad + a'bc **(final expression)**