Landon Leigh ITSC 3181 HW 3

1.

1. 16 = 10000 -> 2's compliment = 010000

   9 = 1001 -> 2's = 001001

   010000 + 001001 = 011001 no overflow

2. 27 = 11011 -> 2's = 011011

   31 = 11111 -> 2's = 011111

   011011 + 011111 = 111010 no overflow

3. -4 = 100 -> 000100 -> 111011 + 1 = 111100

   19 = 10011 -> 010011

   111100 + 010011 = 1001111 yes overflow so 001111

4. 3 = 11 -> 000011

   -32 = 100000 -> 011111 + 1 = 100000

   000011 + 100000 = 100011 no overflow

5. -16 = 10000 -> 01111 + 1 -> 10000

   -9 = 1001 -> 0110 + 1 -> 110111

   10000 + 110111 = 1100111 yes overflow so 100111

6. -27 = 11011 -> 100100 + 1 = 100101

   -32 = 100000 -> 011111 + 1 = 100000

   100101 + 100000 = 1000101 yes overflow so 000101

2. Main:

   ```
   li v0, 5
   syscall
   ```

```
        move t0, v0
        li v0, 5
        syscall
        mov t1, v0
loop:
        beq t1, zero, exit
        add t2, t2, t0
        addi t1, t1, -1
        b loop
exit:
        li v0, 1
        mov a0, t2
        syscall
```

3. Implementation 1: 1(1 + 1 + 1) + 3(5 + 9 + 2 + 2 + 5) + 1(5) = 92 cycles

   Implementation 2: 1(1 + 1 + 1) + 3(9 + 5 + 2 + 2 + 5) = 72 cycles

   So, implementation 2 is faster.

4.
```
main:
        mov ax, data
        mov ad, ax
        lea si, num1
        lea di, num2
        lea bx, result
        mov cx 5
loop:
        mov al, [si]
```

```
add al, [di]
mov [bx], al
inc bx
inc si
inc di
loop
mov ah, 4ch
int 21h
```

5.

Instruction Class	CPI	# inst * 10^6	total cyc * 10^6	Cycles %
add	1	2*10^6 + 1	2*10^6 + 1 = 2000001	7.14
mul	20	1*10^6	20*10^6 = 20000000	71.428
Load/store	2	2*10^6 + 1	4*10^6+2 = 4000002	14.28
branch	2	1*10^6 + 1	2*10^6 + 2 = 2000002	7.14

Total cycles = 28000005

6.

Instruction Class	CPI	# inst * 10^6	total cyc * 10^6	Cycles %
add	1	2001000	2001000	7.14
mul	20	1000000	20000000	71.145
Load/store	2	2001000	4002000	14.29

branch	2	1001000	2002000	7.14

Total cycles = 28005000

7.

1.

a) A’B + AB’ + AB

b) A’B’C + A’BC’ + A’BC + AB’C’ + ABC’

c) A’B’C + ABC’ + ABC

d) A’B’C’D’ + A’B’CD’ + A’B’CD + A’BCD’ + A’BCD + AB’C’D’ + AB’CD’

e) A’B’CD + A’BCD’ + A’BCD + AB’C’D’ + AB’C’D + AB’CD’ + AB’CD

2.

a) A + B

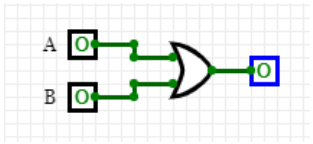
b) A’C’ + AC’ + A’B

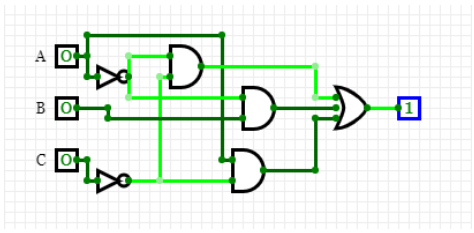
c) A’B’C + AB

d) B’D’ +A’C

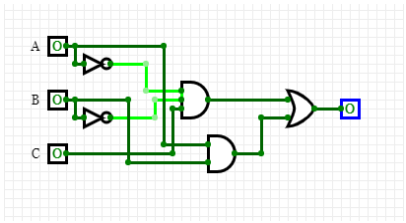
e) A’BC +AB’ + B’CD

3.

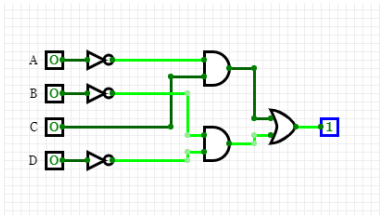
a) 

b) 

c)



d)



e)