Homework Assignment 3 Solution

Exercise 2.12 *(18 points)*

2.12.1 50000000

2.12.2 overflow

2.12.3 B0000000

2.12.4 no overflow

2.12.5 D0000000

2.12.6 Overflow

Exercise 3.1 *(6 points)*

5730

Exercise 3.12 *(20 points)*

Step	Action	Multiplier	Multiplicand	Product
0	Initial Vals	001 010	000 000 110 010	000 000 000 000
1	lsb=0, no op	001 010	000 000 110 010	000 000 000 000
	Lshift Mcand	001 010	000 001 100 100	000 000 000 000
	Rshift Mplier	000 101	000 001 100 100	000 000 000 000
2	Prod=Prod+Mcand	000 101	000 001 100 100	000 001 100 100
	Lshift Mcand	000 101	000 011 001 000	000 001 100 100
	Rshift Mplier	000 010	000 011 001 000	000 001 100 100
3	lsb=0, no op	000 010	000 011 001 000	000 001 100 100
	Lshift Mcand	000 010	000 110 010 000	000 001 100 100
	Rshift Mplier	000 001	000 110 010 000	000 001 100 100
4	Prod=Prod+Mcand	000 001	000 110 010 000	000 111 110 100
	Lshift Mcand	000 001	001 100 100 000	000 111 110 100
	Rshift Mplier	000 000	001 100 100 000	000 111 110 100
5	lsb=0, no op	000 000	001 100 100 000	000 111 110 100
	Lshift Mcand	000 000	011 001 000 000	000 111 110 100
	Rshift Mplier	000 000	011 001 000 000	000 111 110 100
6	lsb=0, no op	000 000	110 010 000 000	000 111 110 100
	Lshift Mcand	000 000	110 010 000 000	000 111 110 100
	Rshift Mplier	000 000	110 010 000 000	000 111 110 100

Exercise 3.21 *(6 points)*

jal 0x00000000

Exercise 3.22 *(10 points)*

0×0C000000 = 0000 1100 0000 0000 0000 0000 0000 0000
= 0 0001 1000 0000 0000 0000 0000 0000 000

S = 0, sign is positive
exponent = 8+16 = 24
Actual Exponent = 24 - 127 = -103
Fraction = 0

Answer = 1.0×2^{-103}

Extra Exercise *(20 points)*

In normalized binary format
a = 1.1011×2^{14}
b = -1.11×2^{-2}

a)
1. Align binary points (shift number with smaller exponent):

-1.11×2^{-2} = - 0.0000 0000 0000 0001 1100 000

2. Add Significands:

```
  1.1011 0000 0000 0000 0000 000
- 0.0000 0000 0000 0001 1100 000
  1.1010 1111 1111 1110 0100 000
```

3. Normalize and round… (no change)

Single precision result: 0100 0110 1101 0111 1111 1111 0010 0000

Normalized binary: + 1.1010 1111 1111 1110 01 × 2^{14}

b)
1. Add exponent:

```
    111 11 1
   100 0110 1
+  011 1110 1
  1000 0101 0
-  011 1111 1     (minus bias)
 1111 1111
   100 0101 1      (new exponent)
```

2. Multiply Significands:

```
                    1.101 1000
                  × 1.110 0000
   1 1011 0000 0000 0000 0000 0000 0000
  11 0110 0000 0000 0000 0000 0000 0000
+ 1. 10 1100 0000 0000 0000 0000 0000 0000
 10. 11 1101 0000 0000 0000 0000 0000 0000
```

3. Normalize and round:

Exponent: 100 0110 0
Significand: 1.011 1101 0000 0000 0000 0000

4. Signs differ, so result is negative: 1100 0110 0011 1101 0000 0000 0000 0000

Normalized binary: - 1.0111 101 × 2^{13}