CS1022 Exercise Set #3
Hilary Term Weeks 9 and 10
Floating-Point Numbers and I/O

1 Floating-Point Numbers

(a) Normalise the following decimal floating point numbers:

(i) 456.789×10^3

(ii) 0.000425×10^{-2}

(b) Convert the following binary floating point numbers to decimal:

(i) 1.1

(ii) 1000.0101

(iii) 0.1111

(c) Convert the following decimal floating point numbers to binary:

(i) 15.25

(ii) 12.1875

(iii) 8.9

(iv) 0.08

(d) Normalise each of the binary floating point numbers in part (c).

(e) Show how you would store each of the normalised floating point numbers from part (d) as a 32-bit word using the IEEE 754 standard.

2 Floating-Point Arithmetic

(a) Decode, align, add, normalise and re-encode each of the following floating point numbers encoded using the IEEE 754 standard, using the approach outlined in lectures.

(i) a=`0x3FA00000`, b=`0x3F400000`

(ii) a=`0x41C40000`, b=`0x41960000`

(iii) a=`0x41A60000`, b=`0x3E400000`

3 GRADED EXERCISE: Implementing Floating-Point Arithmetic

Write an ARM Assembly Language subroutine that will accept as parameters two 32-bit IEE754 encoded floating-point numbers. Your subroutine should add the two floating-point numbers and return a 32-bit IEEE754-encoded result.

You need not consider underflow, overflow or rounding.

You are encouraged to decompose the problem into a number of subroutines, for example, to decode an IEEE754 number into a fraction and exponent and encode a fraction and exponent as an IEEE754.

Thoroughly test your subroutines.

4 BONUS EXERCISE: I/O

Design and implement an extended version of the "blinky" example presented in lectures to detect presses of the push-button connected to P2.10, **without using interrupts.** You should keep a count of the number of times the button has been pressed and store the count as a value in memory.

To achieve this, you will need to modify the configuration of pin P2.10 so it acts as an input rather than an output. You will then need to repeatedly read the state of the P2.10 input to detect when it transitions between high and low (0 and 1).