Floating Point

Part V: IEEE Standard 754

Why? We need to represent real numbers!

Single precision FP (32 bit):

$$\textbf{FP value} = (-1)^{S} \times (1 + F) \times 2^{(E - \text{bias})}$$

Sign (S)	Exponent (E)	Fraction (F) (aka Mantissa)
Bits: [31]	Bits: [30, 23]	Bits: [22, 0]

For single precision FP, S = 1 bit, E = 8 bits, F = 23 bits, bias = 127.

For double precision FP, S = 1 bit, E = 11 bits, F = 52 bits, bias = 1023.

1) Why do we use a bias?

"Special" single precision FP values:

±Zero: E = 0, M = 0

NaN: E = 255, M ≠ 0

±Infinity: E=255, M = 0

Denormalized: E = 0, M ≠ 0

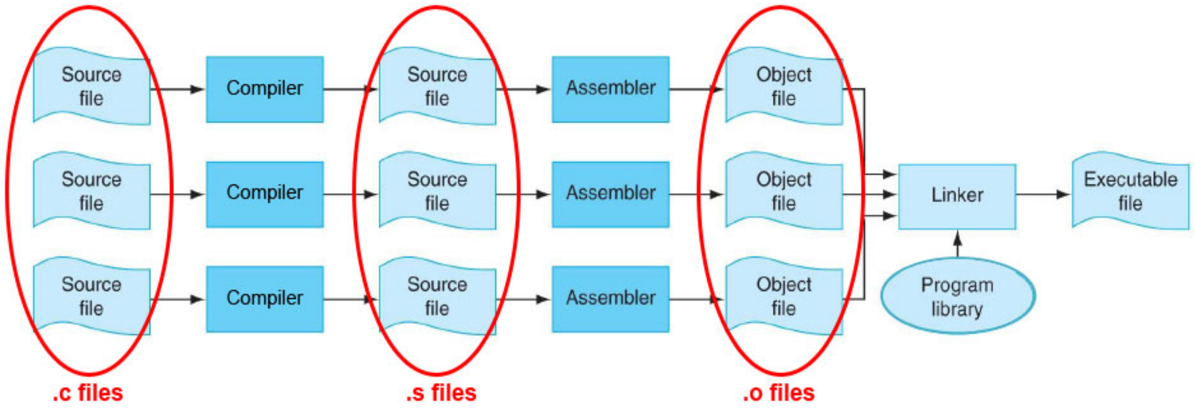
(More on denormal numbers: http://en.wikipedia.org/wiki/Denormal_number)

2) Convert the single precision FP representation, 0xC0B40000, to decimal.

Now we know how to convert from FP representations to decimals, how about the other way around? Google is always your best friend. For example, try this website: http://www.cs.cornell.edu/~tomf/notes/cps104/floating.html#dec2hex

CALL (Compiling, Assembling, Linking, and Loading)

Part VI: It's Turtles all the way down! (aka, How it all fits together):



Assembler: Converts pseudoinstructions to MIPS instructions. Uses the $at register. Converts assembly language into an object file containing:

1) Header – size and position of other parts
2) Text segment – machine language code
3) Static data segment
4) Relocation information – instructions and data words using absolute addressing
5) Symbol table – matches symbols/labels with addresses
6) Debugging information

Linker: Combines independently assembled machine language programs and resolves all remaining undefined labels from the relocation information and symbol table. Result is the executable file.

1) How many passes over assembly code does an assembler have to make and why?

2) Does the linker resolve issues in relative or absolute addressing?

3) What does RISC stand for? How is this related to pseudoinstructions?