CS180 Fall 2011
HW-1 Solutions

Max: 36

1.4What is the difference between native code and bytecode? Under what circumstances would byte code be considered native code?

Ans: (3pts - 1 x 3)
a. Native code or machine code is 'code'(i.e instruction) that can be executed directly by the micro-processor.

b. Byte code is 'intermediate code' which is later interpreted into machine code.

c. Byte code can be considered 'native' only if someone builds a microprocessor that can execute byte code.

1.8 Convert the following binary numbers into decimal(assume that all numbers are positive).
Ans: (5pts - 1 x 5)

100 = 0d4
111 = 0d7
00101 = 0d5
111101 = 0d61
010101 = 0d21

1.10 Convert the following decimal numbers to their hexadecimal and octal equivalents:
Ans: (8 pts - 2 x 4)

29 = 0x1D and 0o35
255 = 0xFF and 0o377
382 = 0x17E and 0o576
4096 = 0x1000 and 0o10000

1.22 Suppose that floating point numbers are represented using a scheme similar to that explained earlier using the IEEE format. However, assume that the biased exponent is represented in 2---bits and the mantissa in 5 bits. Answer the following questions using this new scheme.

Q1) Show the representation of the following numbers: 3.3, 5.5, and -3.25.

Answer: (9pts) - point distribution in table below. It is allright to not have all the steps, as long as the TA is convinced that the student knows how to solve it)

For the given number of bits, bias = 2^1 - 1 = 1

Sample steps for 3.3:
3.3 = 0b11.0100 (ignore bits after 5 decimal points)
= 1.10100 x 2^1

For finding Mantissa, Remove leading bit and add sufficient number of zeros to get 5 bits.

= 10100

For finding exponent, add the bias (1) to exponent in standard notation

= 1 + 1 = 2 = 0b10

+ve, so sign bit is 0

final representation = 0 10 10100

3.3	5.5	-3.25	Points
3.3 = 0b11.0100	5.5 = 0b101.100	3.25 = 0b11.0100	0.5 x 3
= 1.10100 x 2^1	=1.01100 x 2 ^ 2	=1.10100 x 2^1	0.5 x 3
Mantissa = 10100	Mantissa = 01100	Mantissa = 10100	0.5 x 3
Exponent = 1 + 1 = 2 = 10 (in binary)	Exponent = 2 + 1 = 3 = 11 (in binary	Exponent = 1 + 1 = 2 = 10 (in binary)	0.5 x 3
+ve, so sign bit 0	+ve, so sign bit 0	-ve so sign bit is 1	0.5 x 3
3.3 = 0 10 10100	5.5 = 0 11 01100	-3.25 = 1 10 10100	0.5 x 3

Q2) What are the largest and smallest positive numbers?

Answer (2 pts: 1 + 1)

largest = representation 0 10 11111

ie, exponent = 2 - 1 = 1

mantissa = 0b11111

Largest number = 1.11111 x 2^1

=11.111=3.875

credit for 0 11 1111 as well

smallest +ve no (non zero) = 0 00 00001

Q3) What is the maximum relative error?

Answer (3pts:)

maximum relative error = b ^(-p)/2, where b is base, p is the #digits in fraction.

So, in our number system,

max relative error = $2^{-5}/2$ = = 0.015625

Q4) What is the total number of different floating point numbers that can be represented?

Answer(2pts)

number of distinct mantissas = 2^5

number of distinct exponents = 4 (including 11 as exponent)

sign could be +ve or -ve. i.e 2

So total number of different numbers = 2 x 4 x 2^5 = 256 (but this includes +0 and -0, NaN, +infinity, -infinity etc) Any value > 252 can be given credit.

Or 2 x 3 x 2^5=192 (if 11 as exponent is considered incorrect)

2.4 Java is known as an Object---Oriented Programming language. Any idea why?

Answer(2pts)

Java combines data and - methods that operate on that data - into an object and all programs are structured as interactions between these objects. This allows the programming language to expose features like inheritance, polymorphism, encapsulation etc in an elegant fashion.

2.6 What is the difference between a class and an object? Can a class be used to create more than one object? Can a class have multiple methods?

Answer (2 pts: 1 + 0.5 + 0.5)

a) Class is a template used to create objects. Using one such class template, we can create multiple objects, all conforming to the blue-print outlined by the class. These classes are always present in a java environment, ready to create new objects. Objects, on the other hand has a specific life span.

b) Yes

c) Yes