Computing Science 425

Final Examination

December 11, 2000

Section: Szafron

Last Name: _____

First Name: _____

Student #:   _____

Instructions:

The time for this test is 3 hours. <u>No references are allowed.</u> Place all answers in this booklet and do not hand in any other work. The mark total for this exam is 100.

#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	TOTAL
/16	/6	/8	/16	/6	/7	/6	/6	/8	/9	/12	/100

#1 [16 marks] Consider the implementation of Smalltalk-80 that we studied in class.

a) Can a Smalltalk object change its class? Why or why not?

b) Exactly what must happen when a Smalltalk object with indexed instance variables grows (adds some more indexed instance variables)?

c) How many total bytes are required to implement a String object that contains 9 characters? Take into account **all** of the storage space that is used for this object in the implementation studied in class. Draw a diagram so you can get part marks if you have the incorrect number.

d) What is the difference between the home and caller fields of a BlockContext and give one example where they would be bound to different objects.

#2 [6 marks] The grammar for Smalltalk-80 is very small. What two major groups of syntactical constructs exist in most procedural programming languages, but are missing from Smalltalk?

#3 [8 marks] Explicitly describe the difference between overloading and polymorphism by giving Java (not Smalltalk) **examples**.

#4 [16 marks]
    a)   What is a metaclass?

    b)   Why are metaclasses used?

    c)   Describe the basic metaclass structure of Smalltalk.

    d)   Describe the metaclass structure of Java and its advantages and disadvantages compared to Smalltalk.

#5 [6 marks] Briefly describe two weaknesses of Smalltalk and how they are eliminated or reduced Java.

#6 [7 marks] What Java VM construct corresponds to a Smalltalk literal frame, how are they similar and how are they different? Be very specific.

#7 [6 marks] What two Java VM methods appear in compiled Java programs, even though there are no explicit references to them (by name) in the Java source code and what exactly do they do?

#8 [6 marks] If you were implementing a Smalltalk interpreter in a procedural language, you would use two major CASE statements. What would each CASE statement be for?

1.

2.

#9 [8 marks] Describe the two major problems with multiple inheritance and how C++ deals with each of them.

#10 [9 marks]

a) Completely describe one important situation in which Smalltalk avoids method lookup completely.

b) Describe as many situations as you can think of, where Java COULD avoid method lookup completely.

#11 [12 marks] Describe three specific situations in which the Smalltalk interpreter finds a compiled method to execute, but can avoid creating a method context for it. In each case, describe what the interpreter does to execute the compiled method. Be specific about what information the interpreter needs in each case and where it obtains this information. Also describe the role of the object memory by mentioning it every time the interpreter needs it.

1.

2.

3.