Homework 10: Smalltalk

This homework is due Thursday, April 27. Each weekday that the homework is late you lose 10% of the possible points. One point from the total for each of the problems will be awarded for how well your answer is presented (i.e., logic and style).

1. (10 points) Add a method `sort` to the class `Array`, which will cause the reciever to sort itself in order from the least to the greatest element.

2. (15 points) Add a class `Queue` as a subclass of the class `Collection`. This class should implement a FIFO queue, with the following methods: `add:`, `first`, `removeFirst`.

   The method `add:` takes one argument, and adds that object to the tail of the queue. The method `first` returns the head of the queue. The method `removeFirst` removes and then returns the head of the queue.

3. (20 points) Write a program to simulate playing the state lottery. The program should buy 20 tickets, at $1 each and then report on the total amount won (or lost), which is the winnings minus $20 (for the cost of tickets).

   For purposes of this problem assume that the lottery works as follows. You pick 7 distinct numbers from 1 to 42 for each ticket. The state selects seven distinct winning numbers at random from the same set. If your ticket matches all 7 numbers, you win $10,000,000. If your ticket matches 6 numbers, you win $1000. If your ticket matches 5 numbers, you win $10. If your ticket matches 4 numbers, you win $1.

4. The following question explores the relative merits of object-oriented programming versus functional programming.

   (a) (10 points) Describe an applicative subset of Smalltalk-80. That is, list constraints on programs that, if followed, would make Smalltalk-80 programs applicative. For example, you might say that programs should only use one assignment for any variable.

   (b) (10 points) Describe the expressive power of this subset of Smalltalk-80. How practical would Smalltalk-80 programming be with the constraints of part (a)

5. (10 points) In the standard Smalltalk-80 system there are no types that correspond to the records or variant records found in Languages such as Pasal and Ada. Should they have been included in Smalltalk-80? Justify your answer.

6. (20 points) Do the inheritance and the class mechanisms of Smalltalk-80 adequately obey the abstraction principle? Justify your answer. Give specific and concrete suggestions as to how these mechanisms could be improved if you think they need improvement.