

BU CAS CS 320 (SPRING SEMESTER, 2002)
CONCEPTS OF PROGRAMMING LANGUAGES

Assignment 6

Due: Wednesday, the 3rd of April 2002

Total: 210 points + up to 200 bonus points

Exercise 1 (100 base points + up to 200 bonus points) Implementing a blackjack player. Please see the details on the homepage for the class.

Exercise 2 (10 points) Please describe in plain English what the following function does.

```
(define (mystery x)
  (define (loop x y)
    (if (null? x)
        y
        (let ((temp (cdr x)))
          (set-cdr! x y)
          (loop temp x))))
  (loop x '()))
```

Exercise 3 (50 points) In the purely object-oriented language Smalltalk, everything is treated as an object. In particular, numbers are objects. Please use the notion of message-passing to implement number objects in Scheme. More precisely, please implement a function `make-number-object` such that the function takes a number (e.g., 0, 1/2, 3.1415926, etc.) and returns an object representing the number.

- Suppose that n is a number and o_n is an object representing the number. Then your implementation should support the following messages, where `add`, `sub`, `mul` and `div` are symbols.
 1. (`add` o_n): if this message is passed to a number object o_m , then a new object o_{m+n} representing $m + n$ is returned.
 2. (`sub` o_n): if this message is passed to a number object o_m , then a new object o_{m-n} representing $m - n$ is returned.
 3. (`mul` o_n): if this message is passed to a number object o_m , then a new object o_{m*n} representing $m * n$ is returned.
 4. (`div` o_n): if this message is passed to a number object o_m , then a new object $o_{m/n}$ representing m/n is returned.
- Such number objects should be implemented in a style that allows the programmer to add methods without modifying the implementation of number objects. For instance, if the programmer wants to support a method that computes the factorial of n , then he or she should be able to do so without modifying (any) existing code.

Exercise 4 (20 points) Please do Exercise 3.21 in the textbook on page 265.

Exercise 5 (30 points) Please do Exercise 3.25 in the textbook on page 272.