CS2104 – Programming Languages
School of Computing
National University of Singapore

October 6, 2011

Problem Set 6

Semester 1, 2011/12

Due: ***October 27, 23:59***

Marks: 6

Submission: In IVLE, in the cs2104 workbin, you will find a folder called "Homework submissions". In that folder, there are currently 2 ***subfolders:*** **PS6P01,** and **PS6P02**. The last two digits of the folder name indicate the solution that is to be submitted into that folder: the solution to *Question 1* into **PS6P01**, and so on (that is, you need to submit 2 separate solutions to 2 problems). A solution should consist of a ***single text file*** that can be compiled, or loaded into the interpreter of interest and executed. You should provide as much supplementary information about your solution as you can, ***in the form of program comments***. Moreover, if you work in a team, state the members of the team at the beginning of the file, in a comment. You do not need to submit the same file twice, one submission per team is sufficient.

Problem 1 [2 marks, submit to PS6P01]

Write an Oz function that returns the list of all the prime numbers smaller than its argument.

Problem 2 [4 marks, submit to PS6P02]

Consider the following C program:

```
#include <stdio.h>

// builds a string showing the sequence of moves that
// solves the towers of hanoi puzzle -- moving all discs
// from peg 'a' to peg 'b' using peg 'c' as aux
// n is the number of discs, and assumed to be less than 10
void hanoi(char ** p, int n, int a, int b, int c) {
   if ( n == 0 ) return ;
   hanoi(p,n-1,a,c,b) ;
   **p = '0'+(char)a ;
   (*p) ++ ;
   **p = ' ' ;
   (*p) ++ ;
   **p = 't' ;
   (*p) ++ ;
   **p = 'o' ;
   (*p) ++ ;
   **p = ' ' ;
   (*p) ++ ;
   **p = '0'+(char)b ;
   (*p) ++ ;
   **p = '\n' ;
   (*p) ++ ;
   hanoi(p,n-1,c,b,a) ;
}

int main() {
  char a[1000] ;  // string buffer
  char *p = a ;   // current position in string
  hanoi(&p,4,1,2,3) ; // build the string of moves for 4 discs
  *p = '\0' ;     // terminate the string
  // printf(a) ; // string could be printed, but not in VAL code
}
```

The program builds a string which, when printed, lists the sequence of moves for the tower of hanoi puzzle with 4 discs, moving all discs from the first peg to the second peg, using the third peg as an auxilliary. Translate the above program into VAL.

Further Practice Problems

These problems are for your own individual practice. Solutions are not to be submitted, and will not be marked. You are, however, allowed to post your solutions in the forum for comparison and discussion. Good posts will earn marks.

Further Practice Problem 1

Build a continuation-passing-style solution to Problem 2. (Continuation passing style is the style of programming in Exercise 4 of Tutorial 7).

Further Practice Problem 2

Write an Oz solution to the half-interval method given in Lecture 7.

Further Practice Problem 3

Write an Oz program that prints all the permutations of a list.

Further Practice Problem 4

Consider the sequence of numbers with the following properties:

- Each number in the sequence is either a multiple of 2, or a multiple of 3, or a multiple of 5.
- The sequence does not have duplicates.
- The numbers in the sequence appear in increasing order.

Write an Oz program that prints the first N members of this sequence.