Static Program Analysis
SS 2011
Exercise Sheet 8

Please hand in the solutions to the theoretical exercises until the beginning of the lecture on Wed. 2011-07-13, 10:00. Please write the number of your tutorial group and/or the date/time slot on the first sheet of your solution.

Exercise 8.1: A Closer Look At TVLA’s Examples

Swap (Points: 4)
Take a closer look at the swap example (sll/swap.tvp). Note that the control-flow graph in this example is erroneous. Fix this and run the analysis. Consider the structures arising at program state exit. They just show that the function does always preserve list properties but that the first two elements of the input list switched places is not shown. Also fix this by making the analysis precise enough to clearly show that pointer \( x \) now points to the former second element of the list and that the former first element is now the second element.

Delete (Bonus points: 6)
Improve the analysis of ./sll/delete.tvp in order to prove that:

1. if an element was deleted from the list, then this element stored a value equal to \( \text{delval} \),
2. if nothing was deleted when the function finishes, \( \text{delval} \) was not stored at any list element.

Exercise 8.2: Inlining and Tail Recursion (Points: 2)
Consider the following functions \( f, f1, \) and \( \text{main} \). Remove tail recursion from \( f1 \) and perform inlining afterwards.

```c
f1() {
if(n <= 1)
  x = 1;
  z = y;
else {
  f1();
  n = n - 1;
  z = x + y;
  x = y;
  y = z;
  f1();
}
}
```

```c
f() {
  x = 1;
  y = 1;
  f();
}
```

```c
main() {
  n = M[17];
  f();
  M[42] = z;
}
```