CS 345 — Fall 2001	Homework #3
Programming Languages	Due October 29, 2001

1. Sethi 5.9 (There is a typo in this question, look at Fig. 5.21 and Fig. 5.23 – not Fig. 5.22 and Fig. 2.23)

2. Sethi 5.10

3. Assume we have a language C-flat, which is similar to C, but allows nested procedures and doesn't allow any instructions or types that would prevent it from having a strong static type system.

We would like to add a nested return statement to this language so that we can return from an outer procedure from within an inner procedure. For example, the function f below will return 0 if x is positive and 1 otherwise.

```
int f(int x)
   void g() {
      void h() {
         return (f) 0;
      }
      h();
   }
   if (x > 0)
      g();

   return (f) 1;
}
```

The following pseudo-assembly code implements this return statement in the case when its procedure argument is the current procedure and the value to return is in the register rv:

```
sp = ep
ra = M[ep+4]
M[ep] = rv
jump_return ra
```

I assume the offset for the return address is 4 and the return value is placed at the (callers) current stack pointer. I also assume that the caller will restore its ep. Note that jump_return jumps to the address in its register argument (ra).

Use these assumptions when doing the following problems. You may also assume the register ap is available and that the static link is stored at ep.

a) What modifications should we make to the compiler to ensure that the function passed into return encloses the current procedure?

b) Can C-flat still have a strong static type system? Explain.

c) Use our pseudo-assembly language to implement return in the case where the function has a static distance of 2 and the return value is in the register rv.

d) Implement return in the case where the function has a static distance of 4 and there is no return value (the function passed in is void).

e) What do we do if the static distance is 0?