

**Problem 1**

Exercise 7.1 in the Mitchell book.

**Problem 2**

Exercise 7.8 in the Mitchell book.

**Problem 3**

```

int g( );
{
  int i, j, k;          --block 1
  while (...)          --1
  {
    int i, k;          --block 2
    ...while (...)    --2
    {
      int j;          --block 3
      ...              --3
    }                  --end block 3
    if (...)           --block 4
    {
      int i, l;       --4
      ...
    }                  --end block 4
  }                    --end block 2
  if (...)
  {
    int a, b, c, d;   --block 5
    ...
  }                    --end block 5
}                       --end block 1

```

Describe scope and life-time of the various variables wrt to the different blocks. Use the proposed names of the blocks and the lines of interest.

#### Problem 4

```
int i=1, j=2, k=3;
alpha() {
  int i=4, l=5;
  ...
  i=k+1;
  beta();
  ...
};
beta() {
  int k=6;
  ...
  i=j+k;
  alpha();
  ...
};
main() {
  ...
  beta ();
  ...
}
```

Describe each stage of the run-time stack until beta is call recursively by alpha. Show static and dynamic links.

#### Problem 5

```
f2() {
  int i;
  ...
  ... i ...;
  ... j ...;
  ...
}
f1() {
  int j;
  ...
  ... i ...;
  ... k ...;
  f2();
  ...
}
main() {
  int i, j, k;
  k = 0;
  i = 5;
  j = 7;
  f1();
  f2();
  ...
}
```

Assume that this is written in a language with dynamic scoping. What will happen at the two calls f1() and f2(): to which declarations will the applications of i,j,k within f1 and f2 be bound?

### Problem 6

This is an example in a language with static scoping.

```
int x, y, z;
f1()
{
  int t, u;
  f2()
  {
    int x, w;
    f3()
    {
      int y, w, t;
      ... ;
      f2();
      ...
    }
    x = y + t + w + z;
    f3() ;
  }
  ...;
  f2();
  ...
}
main();
{
  int z, t;
  ...
  f1();
  ...
}
```

Show run-time stack with both dynamic and static links for following call sequence: main; f1(); f2(); f3(); f2().

Explain what happens with variable bindings in when executing 'x = y + t + w + z' in the latest call of f2. Look especially at y, t and z.

### Problem 7

Exercise 7.4 in Mitchell.

### Problem 8

Exercise 7.7 in Mitchell.

### Problem 9

Consider the example below. Discuss call by reference and call by value-result for swap(a[i], a[j]). What happens if i=j?

```
swap(int x, int y) {
  x = x + y;
  y = x - y;
  x = x - y;
}
```