Homework # 3
due February 16, 11:00 AM

1 Simple ML Programs

(a) Write a function `scale` that takes a real and a list of reals and returns a list which multiples the number to every element in the list. For example:

```
- scale (3.0,[1.0,2.0,3.0]) ;
val it = [3.0,6.0,9.0] : real list
```

(b) Write a function `dot` that takes two lists of real numbers of the same length and returns the "dot product" (the sum of the element-wise multiplication). For example:

```
- dot ([1.0, 2.0],[~3.0, 4.0]) ;
val it = 5.0 : real
```

Your program need not be well-behaved when the lists are not the same length.

(c) Write a function `magn` that takes a list of real numbers and returns the square root of the sum of the squares of the elements. Hint, you can use `dot` to do most of the work.

```
- magn [1.0,1.0,1.0,2.0,3.0] ;
val it = 4.0 : real
```

(You will need to "`open Math`" to make the `sqrt` function available.)

(d) Use all these functions to define a function project that "dots" the two list arguments together and divides the result by the square of the magnitude of the second, and then uses the result to scale the second. This operation projects the first vector onto the second.

```
- project ([1.0,1.0],[2.0,0.0]);
val it = [1.0,0.0] : real list
```

Put all your functions in a single file named `vector.sml` in your AFS volume under directory `homework3`.

2 Types

Do Exercises 1 and 2 of Chapter 6 (pages 101–102). Write your answers on paper.

3 Submitting Your Work

Turn in the first part in AFS, and the second part on paper at the beginning of lecture.