COMP 410
Fall 2019

Modes, Determinism, and Mercury

1.) Consider the following procedure and query:

```
decBound(In, Out) :-
    In > 0,
    Out is In - 1.

?- decBound(4, Result).
Result = 3.
```

1.a.) Write a mode declaration for `decBound` below, corresponding to the above query.

1.b.) Write a mode declaration corresponding to the following `decBound` query:

```
?- decBound(4, 3).
true.
```

2.) Consider the following procedure:

```
foo(1).
foo(2).
foo(3).
```

Write out every possible mode declaration below for the above procedure. As a hint, there should be only be two, one where `foo` takes an input, and another where `foo` produces an output.

3.) Prolog's `between/3` procedure can be used to find all the numbers within a range, or to check that a given number exists within a range. Example queries are below:

```
?- between(0, 3, X). % min = 0, max = 3
X = 0 ;
X = 1 ;
X = 2 ;
X = 3.
?- between(0, 3, 2). % min = 0, max = 3
true.
?- between(3, 0, 2). % min = 3, max = 0
false.
```

Implement the `between/3` procedure below in Mercury. Be sure to give it the mode annotations necessary to execute the queries above. As a hint, the base case needs to succeed whenever `min <= max`.

4.) Implement a procedure named `sumList/2` in Mercury, which takes:

1. A list of integers (represented with the type `list(int)` in Mercury). This list will always be provided.
2. A single integer, holding the sum of the list. This integer is always an output.

Be sure to provide appropriate mode annotations. The sum of an empty list is `0`.