1 Synthesis with Sketch

In this assignment you will use Sketch to solve a simple programming by example problem. In particular, your task is to generate a program in a simplified version of a score card classifier like the one we discussed in class (see credit scorecards as an example https://en.wikipedia.org/wiki/Credit_scorecards).

Your tasks for this assignment are the following:


2. Write a generator for expressions $E(x)$ of the form $x+??$ or $x-??$. (Sketch only allows positive numbers in holes so these are different expressions).

3. Write a generator $G(x)$ for guards of the form $x \geq ??$ or $x \leq ??$.

4. Write a Sketch of the following form

```plaintext
bit f(int [5] x){
    int c = 0;
    if (G(x[0]))
        c = E(c);
    if (G(x[1]))
        c = E(c);
    if (G(x[2]))
        c = E(c);
    if (G(x[3]))
        c = E(c);
    if (G(x[4]))
        c = E(c);
```

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return G(c);
}

5. Use this Sketch to find a program with the following input/output specification.

```java
assert(f({5,5,5,5}) == false);
assert(f({5,5,5,10}) == true);
assert(f({5,5,10,10}) == true);
assert(f({5,10,10,10}) == true);
assert(f({10,10,10,10}) == true);
assert(f({10,10,5,5}) == true);
assert(f({10,10,5,10}) == true);
assert(f({5,10,5,5}) == true);
assert(f({5,10,5,10}) == true);
assert(f({10,10,10,10}) == true);
assert(f({5,5,5,5,5,5}) == false);
assert(f({5,5,10,10,10,10}) == false);
assert(f({5,5,5,5,10,10}) == false);
assert(f({5,5,5,10,10,10}) == false);
assert(f({5,5,10,10,10,10}) == false);
assert(f({5,5,5,10,10,10}) == false);
assert(f({5,5,5,5,10,10}) == false);
assert(f({5,5,5,5,10,10}) == false);
```

6. Can you find a set of examples for which no program in this Sketch exists? (not one in which a completion exists but the Sketch just timeouts).

**What to turn in?** Submit a zip containing

- Your Sketch implementation.
- Screen shots of the results of running the tool on the examples.
- The counterexample.