Programming Uncertain Things

Kathryn S. McKinley

Programs perform (probabilistic) inference, even if they don’t realize it.

They use **evidence** to draw **conclusions**

```
GeoCoordinate Loc = GPS.GetLocation ();
if (GPS.Distance (Loc, Home) < 200) // Evidence
    OpenGarageDoor (); // Conclusion
```
What do probabilistic programs mean?

```c
float obfuscated(float n) {
    return n + gaussian(0.0, 1000.0);
}

float average_salary(float* salaries) {
    total = 0.0;
    for (int i = 0; i < COUNT; ++i)
        total += obfuscated(salaries[i]);
    avg = total / len(salaries);
    p_avg = 10
```
What if we could identify inputs that cause bad outputs?

```c
float obfuscated(float n) {
    return n + gaussian(0.0, 1000.0);
}
float average_salary(float* salaries) {
    total = 0.0;
    for (int i = 0; i < COUNT; ++i)
        total += obfuscated(salaries[i]);
    avg = total / len(salaries);
    p_avg = ...;
    passert e, p, c
}
Identifying when things go bad

```c
float obfuscated(float n) {
    return n + gaussian(0.0, 1000.0);
}
float average_salary(float* salaries) {
    total = 0.0;
    for (int i = 0; i < COUNT; ++i)
        total += obfuscated(salaries[i]);
    avg = total / len(salaries);
    p_avg = ...;
    passert e, p, c
}
```