

Random Walks and More Plotting, Segment 2

Last Segment

- Presented a related collection of data abstractions
 - Location
 - Field
 - Drunk
 - UsualDrunk
 - ColdDrunk
- Talked about structuring simulations
 - Simulate one walk of k steps
 - Simulate n such walks
 - Report aggregated results.

Simulating a Single Walk

```
def walk(f, d, numSteps):  
    """Assumes: f a Field, d a Drunk in f, and  
        numSteps an int >= 0.  
        Moves d numSteps times; returns the distance  
        between the final location and the location  
        at the start of the walk."""  
    start = f.getLoc(d)  
    for s in range(numSteps):  
        f.moveDrunk(d)  
    return start.distFrom(f.getLoc(d))
```

Simulating Multiple Walks

```
def simWalks(numSteps, numTrials, dClass):
    """Assumes numSteps an int >= 0, numTrials an
        int > 0, dClass a subclass of Drunk
        Simulates numTrials walks of numSteps steps
        each. Returns a list of the final distances
        for each trial"""
    Homer = dClass()
    origin = Location(0, 0)
    distances = []
    for t in range(numTrials):
        f = Field()
        f.addDrunk(Homer, origin)
        distances.append(round(walk(f, Homer,
                                   numSteps), 1))
    return distances
```

Putting It All Together

```
def drunkTest(walkLengths, numTrials, dClass):
    """Assumes walkLengths a sequence of ints >= 0
        numTrials an int > 0,
        dClass a subclass of Drunk
        For each number of steps in walkLengths,
        runs simWalks with numTrials walks and
        prints results"""
    for numSteps in walkLengths:
        distances = simWalks(numSteps, numTrials,
                              dClass)
        print(dClass.__name__, 'random walk of',
              numSteps, 'steps')
        print(' Mean =',
              round(sum(distances)/len(distances), 4))
        print(' Max =', max(distances),
              'Min =', min(distances))
```

Let's Try It

```
drunkTest((10, 100, 1000, 10000), 100,  
          UsualDrunk)
```

UsualDrunk random walk of 10 steps

Mean = 8.634

Max = 21.6 Min = 1.4

UsualDrunk random walk of 100 steps

Mean = 8.57

Max = 22.0 Min = 0.0

UsualDrunk random walk of 1000 steps

Mean = 9.206

Max = 21.6 Min = 1.4

UsualDrunk random walk of 10000 steps

Mean = 8.727

Max = 23.5 Min = 1.4

Let's Try a Sanity Check



- Try on cases where we think we know the answer
 - A very important precaution!

Sanity Check

```
drunkTest((0, 1, 2) 100, UsualDrunk)
```

UsualDrunk random walk of 0 steps

Mean = 8.634

Max = 21.6 Min = 1.4

UsualDrunk random walk of 1 steps

Mean = 8.57

Max = 22.0 Min = 0.0

UsualDrunk random walk of 2 steps

Mean = 9.206

Max = 21.6 Min = 1.4

And the Heat-seeking Drunk?

```
class ColdDrunk(Drunk):
    def takeStep(self):
        stepChoices = [(0.0, 0.9), (0.0, -1.1),
                        (1.0, 0.0), (-1.0, 0.0)]
        return random.choice(stepChoices)

def simAll(drunkKinds, walkLengths, numTrials):
    for dClass in drunkKinds:
        drunkTest(walkLengths, numTrials, dClass)

random.seed(0)
simAll((UsualDrunk, ColdDrunk),
       (1, 10, 100, 1000, 10000), 100)
```