Python for Science and Engg: Statistics

FOSSEE

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Day 1, Session 3

Outline

Value of acceleration due to gravity?

- We already have pendulum.txt
- We know that $T = 2\pi\sqrt{\frac{L}{g}}$
- So $g = \frac{4\pi^2 L}{T^2}$
- Calculate “g” - acceleration due to gravity for each pair of L and T
- Hence calculate mean “g”

Acceleration due to gravity - “g”...

```
In []: G = []
In []: for line in open('pendulum.txt'):
   ....:     point = line.split()
   ....:     l = float(point[0])
   ....:     t = float(point[1])
   ....:     g = 4 * pi * pi * l / t * t
   ....:     G.append(g)
```

Computing mean “g”

Exercise

Obtain the mean of “g”

Mean “g”

```
total = 0
for g in G:
    total += g

g_mean = total / len(g)
print "Mean: ", g_mean
```

Mean “g”

```
g_mean = sum(G) / len(G)
print "Mean: ", g_mean
```

Mean “g”

```
g_mean = mean(G)
print "Mean: ", g_mean
```

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Outline

More on data processing

We have a huge data file–180,000 records.
How do we do *efficient* statistical computations, i.e. find mean, median, standard deviation etc; draw pie charts?

Structure of the file

Understanding the structure of sslc1.txt

- Each line in the file has a student's details(record)
- Each record consists of fields separated by ';'

```
A;015162;JENIL T P;081;060;77;41;74;333;P;;
```

Structure of the file . . .

A;015163;JOSEPH RAJ S;083;042;47;AA;72;244;;;

Each record consists of:

- Region Code
- Roll Number
- Name
- Marks of 5 subjects: English, Hindi, Maths, Science, Social
- Total marks
- Pass/Fail (P/F)
- Withheld (W)

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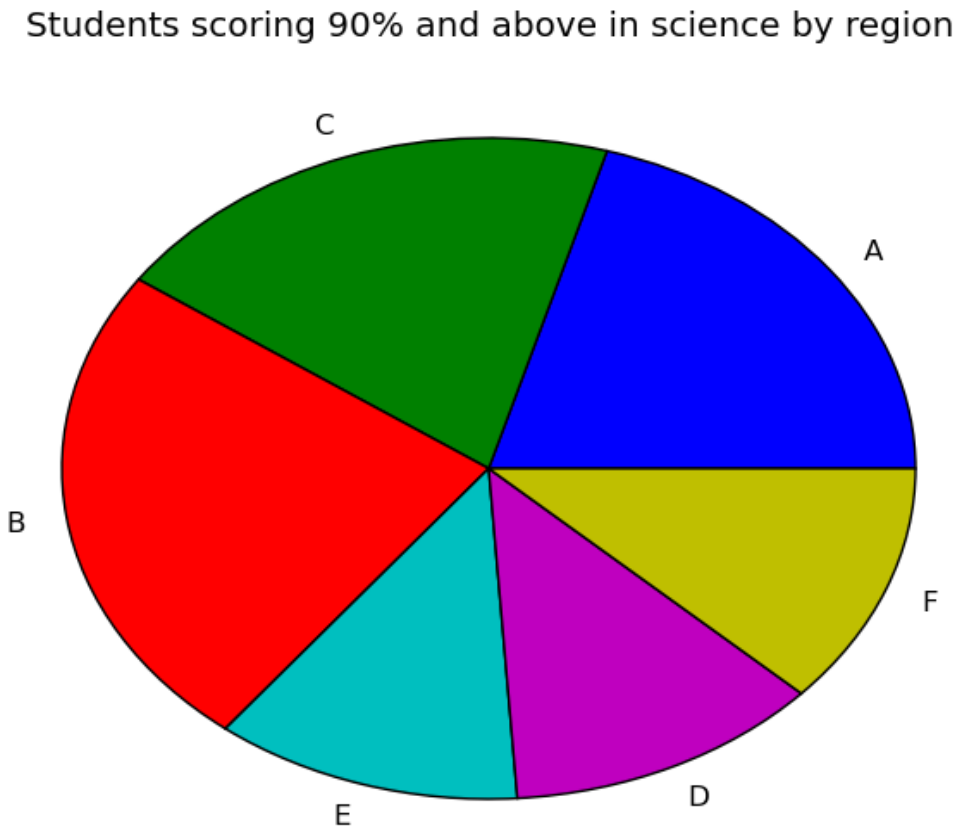
Statistical Analysis: Problem statement

1. Read the data supplied in the file *sslc1.txt* and carry out the following:
   a. Draw a pie chart representing proportion of students who scored more than 90% in each region in Science.
   b. Print mean, median and standard deviation of math scores for all regions combined.

Problem statement: explanation

a. Draw a pie chart representing proportion of students who scored more than 90% in each region in Science.



Machinery Required

- File reading
- Parsing
- Dictionaries
- Arrays
- Statistical operations

Outline

File reading and parsing . . .

```
for record in open('sslc1.txt'):
    fields = record.split(';')
```

Recall pendulum example!

Outline

Dictionaries: Introduction

- lists index: 0 . . . n
- dictionaries index using strings

Dictionaries . . .

```
In [ ]: d = {"jpg" : "image file",
        "txt" : "text file",
        "py" : "python code"}

In [ ]: d["txt"]
Out[ ]: 'text file'
```

Dictionaries . . .

```
In [ ]: "py" in d
Out[ ]: True

In [ ]: "cpp" in d
Out[ ]: False
```

Dictionaries . . .

```
In [ ]: d.keys()
Out[ ]: ['py', 'txt', 'jpg']

In [ ]: d.values()
Out[ ]: ['python code', 'text file',
         'image file']
```

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Getting back to the problem

Let our dictionary be:

```
science = {}
```

- Keys will be region codes
- Values will be the number students who scored more than 90% in that region

Sample *science* dictionary

{'A': 729, 'C': 764, 'B': 1120,'E': 414, 'D': 603, 'F': 500}

Building parsed data . . .

```
science = {}

for record in open('sslc1.txt'):
    record = record.strip()
    fields = record.split(';')

    region_code = fields[0].strip()
```

Building parsed data . . .

```
if region_code not in science:
    science[region_code] = 0

score_str = fields[6].strip()

score = int(score_str) if \
    score_str != 'AA' else 0

if score > 90:
    science[region_code] += 1
```

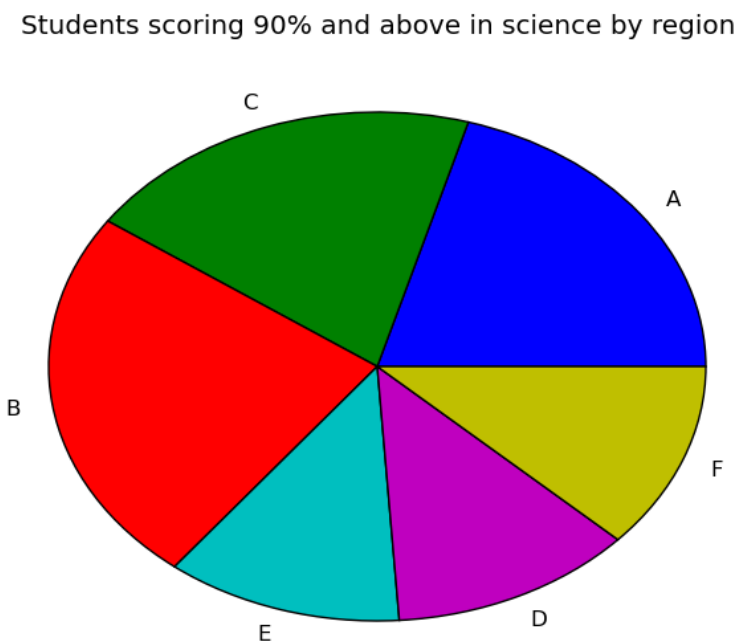
Building parsed data . . .

```
print science
print science.keys()
print science.values()
```

Outline

Pie chart

```
pie(science.values(),
    labels = science.keys())
title('Students scoring 90% and above
      in science by region')
savefig('science.png')
```



Problem statement

b. Print mean, median and standard deviation of math scores for all regions combined.

Building data for statistics

```
math_scores = []

for record in open('sslc1.txt'):
    record = record.strip()
    fields = record.split(';')

    score_str = fields[5].strip()
    score = int(score_str) if \
      score_str != 'AA' else 0

    math_scores.append(score)
```

Outline

Obtaining statistics

Exercise

Obtain the mean of Math scores

Obtaining statistics

```
print "Mean: ", mean(math_scores)

print "Median: ", median(math_scores)

print "Standard Deviation: ",
                    std(math_scores)
```

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Obtaining statistics: efficiently!

```
math_array = array(math_scores)

print "Mean: ", mean(math_array)

print "Median: ", median(math_array)

print "Standard Deviation: ",
                    std(math_array)
```

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What tools did we use?

- Dictionaries for storing data
- Facilities for drawing pie charts
- Efficient array manipulations
- Functions for statistical computations - mean, median, standard deviation