

ECE 341 - Homework #10

Testing with Normal Distributions & Regression Analysis. Due Thursday, June 2nd

Testing with Normal Distributions

Let A be the sum of 10 uniform distributions in the range of (0,6)

$$A = \text{sum}(6 * \text{rand}(1, 10));$$

Let B be the sum of 8 uniform distributions in the range of (0,10)

$$B = \text{sum}(10 * \text{rand}(1, 8));$$

1) What is the mean and standard deviation for A and B?

For A:

$$\mu_a = 10 \cdot \left(\frac{0+6}{2} \right) = 30$$

$$\sigma_a^2 = 10 \cdot \left(\frac{(6-0)^2}{12} \right) = 30$$

For B

$$\mu_b = 8 \cdot \left(\frac{0+10}{2} \right) = 40$$

$$\sigma_b^2 = 8 \cdot \left(\frac{(10-0)^2}{12} \right) = 66.67$$

2) Using a normal approximation, determine the 90% confidence interval for A.

From StatTrek, 5% tails corresponds to a z-score of 1.645

$$\mu - 1.645\sigma < A < \mu + 1.645\sigma$$

$$20.99 < A < 39.01$$

3) Using a normal approximation, determine the probability that $A > 40$.

$$z = \left(\frac{40-30}{\sqrt{30}} \right) = 1.8257$$

From StatTrek, this corresponds to a probability less than 0.034

There is a 3.4% chance that A will be more than 40

4) Let Y be a sample from either A or B. To determine which group Y came from, a threshold test is used:

- If $Y < 35$, Y is assumed to be from A (negative)
- If $Y > 35$, Y is assumed to be from B (positive)

Determine the probability of

- A false positive (Y is from A but testing resulted in it being assigned to population B)
- A false negative (Y is from B but testing resulted in it being assigned to population A)

The z-score for $A > 35$ is

$$z = \left(\frac{35-30}{5.4772} \right) = 0.9129$$

From StatTrek, this corresponds to a probability of 0.181

There is an 18.1% chance of a false positive

The z-score for $B < 35$ is

$$z = \left(\frac{40-35}{8.165} \right) = 0.6124$$

From StatTrek, this corresponds to a probability of 0.270

There is a 27.0% chance of a false negative

Regression Analysis

The average temperature in June in Fargo, ND is available at

http://www.bisonacademy.com/ECE111/Code/Fargo_Weather_Monthly_Avg.txt

5) Find the least-squares curve fit for this data as

$$T = ay + b$$

where T is the temperature in degrees F and y is the year.

From this curve fit, how much has June in Fargo warmed up since 1942?

```
>> June = DATA(:, 7);
>> year = DATA(:, 1);
>> B = [year, year*0+1];
>> A = inv(B'*B)*B'*June

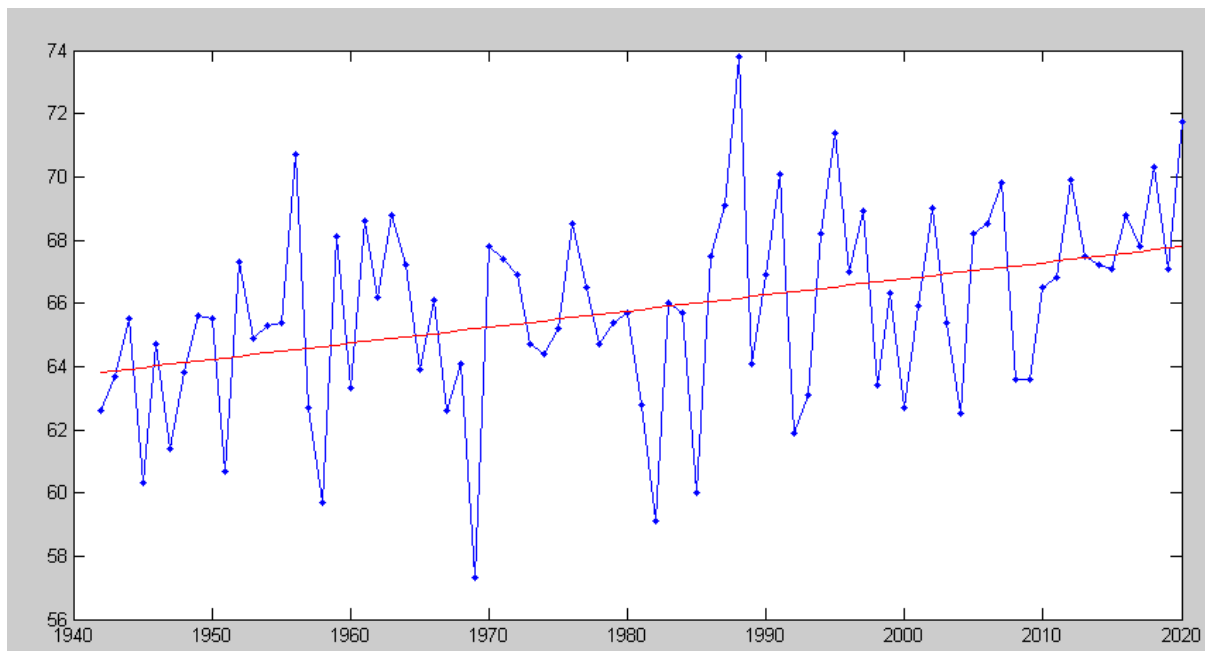
A =

    0.0510
   -35.2987

>> plot(year, June, 'b.-', year, B*A, 'r');
```

In 80 years, the average temperature has gone up 4.08 degrees F

$$dT = 0.0510 \cdot 80 = 4.08F$$



6) Determine the correlation coefficient between

The average temperature in June and July

if June is hot, is July going to be hot?

```
>> July = DATA(:, 8);
>> June = DATA(:, 7);

>> Cov = mean(June .* July) - mean(June) * mean(July)

Cov =

    2.8057

>> correlation = Cov / ( std(June) * std(July) )

correlation =

    0.3624
```

The average temprature in June and January.

if January is hot, is June going to be hot?

```
>> June = DATA(:, 7);
>> Janiary = DATA(:, 2);
>> January = DATA(:, 2);
>> Cov = mean(June .* January) - mean(June) * mean(January)

Cov =

    3.5356

>> correlation = Cov / ( std(June) * std(January) )

correlation =

    0.1640

>>
```