MET3220C & MET6480
Computational Statistics

Programming – week #6

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/usr/lib/sendmail drock@met.fsu.edu < AS6a_your_last_name.f90
/usr/lib/sendmail drock@met.fsu.edu < AS6b_your_last_name.f90
/usr/lib/sendmail drock@met.fsu.edu < graphics_your_last_name.???

Review of Secure Shell (ssh)

- When logging into your account, from your account on a different computer in the same domain (example domain: met.fsu.edu):
  - ssh metlab
- When logging into your account from a different person's account on a computer (different or the same) in the same domain:
  - ssh login_id@metlab
- When logging into your account from account with the same login id, but on a computer in a different domain:
  - ssh metlab.met.fsu.edu
- When logging into your account from account with a different login id, and on a computer in a different domain:
  - ssh login_id@metlab.met.fsu.edu

GREP: used as a debugging tool
Or as a locating tool

- The UNIX command grep can be very useful for debugging, particularly with more complex codes.
  - Example: grep standev_tmax2 AS4_bourassa.f90
  - Returns:
    - A lot. Check it out with your own code
  - Example: grep ‘OPEN(‘ *.f90
- The output from grep can be sent to a file.
- Example: grep ‘standev_tmax2 =‘ AS4_bourassa.f90 > temp
  - The advantages of sending it to a file is that it is available to be examined later (or seen if the output is very long), and
  - Grep can be used again on the file
    - Example: grep standev_y temp

Assignment #6
Writing to files and Viewing Output

- Assignments 4 and 5 will be modified to write the data to file
- Assignment 5 will be further modified to consider the rain flag
- Xmgrace will be used to view data and theoretical fits to the data.
- Due date is Thursday Feb. 23rd at 5:00PM (local time)

Modifications Related to the Rain Flag

- In AS5, your code was:

```
IF ( index .GT. 0 .AND. index .LE. n_bins ) THEN
    histogram(index) = histogram(index) + 1
    i_good = i_good + 1
ENDIF
```

- We want to modify if to calculate two additional histograms.
  - The distribution of non-flagged wind speeds
  - The distribution of flagged wind speeds

- Inside the block shown above, we will add similar code to check the flag and update the new histograms

Modifications Related to the Rain Flag

- In AS6b, your code will be:

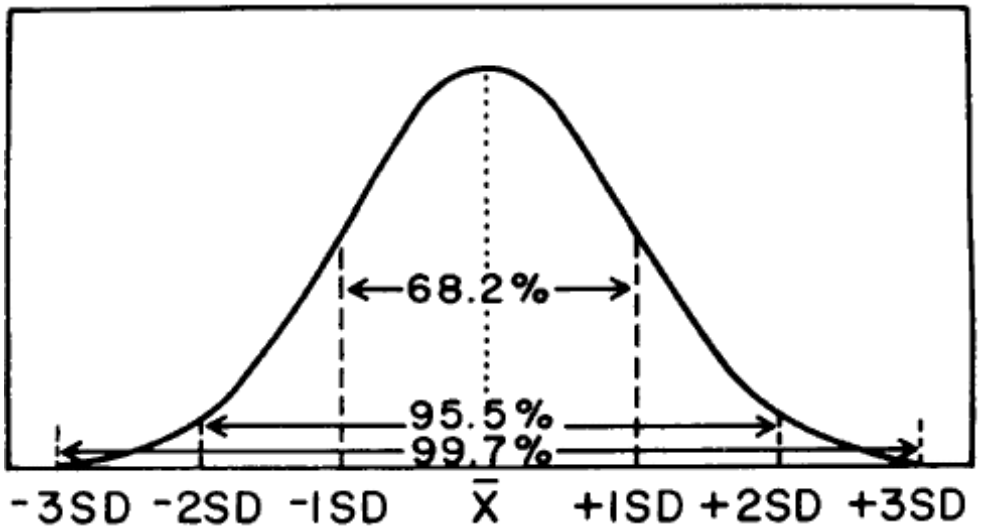
```
IF ( index .GT. 0 .AND. index .LE. n_bins ) THEN
    histogram(index) = histogram(index) + 1
    i_good = i_good + 1
    IF ( qscat_flag .EQ. 0 ) THEN !update histogram of the non-flagged data
        histogram2(index) = histogram2(index) + 1
        i_good2 = i_good2 + 1
    ELSE  !update histogram of the rain flagged data
        histogram3(index) = histogram3(index) + 1
        i_good3 = i_good3 + 1
    ENDIF
ENDIF
```

Gaussian Distribution: The Formula

- A normal distribution is described by two parameters: a mean (μ) and a standard deviation (σ).
- A Gaussian distribution (not a pdf) would also have an amplitude.

$$pdf = f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{(x-\mu)^2}{2\sigma^2}\right], \quad -\infty < x < \infty$$

- Think about how the the standard deviation influences the shape of $f(x)$.
  - Larger σ implies a wider peak, and a smaller amplitude.



Graphic from http://homepage.univie.ac.at/Franz.Vesely/cp0102/dx/img579.png

Log-Normal Distributions

- There are many occurrences of distributions that have
  - (1) only positive values, and
  - (2) peak is displaced to the left.
- Some of these distributions are log-normal distributions.
  - A transformation of variables is used: $y = \ln(x)$

$$pdf = f(x) = \frac{1}{x\sigma_y\sqrt{2\pi}} \exp\left[-\frac{\left(\ln(x) - \mu_y\right)^2}{2\sigma_y^2}\right], \quad -\infty < y < \infty, \; y = \ln(x)$$

  - Where μ_y and σ_y are the mean and standard deviation of the transformed variable y.

- The mean of x is $\exp[\mu + \sigma^2/2]$, and
  The standard deviation of x is $(\exp[\sigma^2] - 1)\exp[2\mu + \sigma^2]$,
  - Where μ and σ are the mean and standard deviation of the transformed variable y.

Theoretical Distributions
What Points to Plot?

- For visualization purposes, you could plot at any interval that you want.
  - N_pts = (max_value – min_value) / resolution
  - X_value(j) = min_value + (j-1) * resolution !in a DO loop
- For statistical comparisons (which we will do in later classes) you would want the values at the center of the bins, or better yet the mean of the values in the bin.
  - Use formulas similar to above, but use bin_width instead of resolution.