

Lab 4

Lab 4Due October 6th

****Remember to support your answers with evidence from the data. Describe how and why you have come to a conclusion. If you show me a graph tell me what you see in the graph that helps prove your answer.****

Project 1:

Perth Australia is known to have a "Mediterranean climate". This means that it receives most of its precipitation in the winter, and very little during summer. Examine the monthly total precipitation at Perth, in southwestern Australia, for 1876 to 2003.

Q: In looking at the data for Perth, is this general seasonal pattern obvious?

Q: If a t-test were done comparing mean winter to mean summer precipitation (say, January vs. July), would you expect the difference to be statistically significant? (You do not have to perform the t test.)

There has been concern that precipitation has been gradually decreasing in western Australia over the last 50 or so years. Sometimes, however, such beliefs are not supported by actual data. Using the precipitation data at Perth, do a statistical test of difference between July precipitation from 1876 to 1950 (to be regarded as the "population") and the July precipitation from 1980 to 2003. Recall that

$$t = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

where μ is the mean of the true population, \bar{x} is the mean of our sample, σ is the standard deviation and n is the averaging period. You can have Excel calculate t for you and use the table from your book to test the significance of the t value for 95% confidence.

Q: Does the precipitation of the recent 24 years appear to come from the "population"?

Q: How is our treatment of the early time period as the population flawed?

Perform the statistical test a second time, but now using the total precipitation for the four normally wettest months of the year (June, July, August, September). (i.e. sum June+July+Aug+Sept for each year and use that time series as your sample).

Q: Does the statistical test result turn out to be stronger or weaker than for July alone? Why?

Project 2: Global warming has become an issue receiving much attention in the last decade. Let's look at some data to see if it appears obvious at individual stations, and try to isolate it from the effect of urban growth in and around the station.

Arizona

Examine the monthly temperature averages in Phoenix, Arizona, in the southwest U.S. Plot the mean January temperature for Phoenix for 1901 to 2003.

Q: Is a warming trend shown? Try July. Is a warming trend shown for July also?

Perform a significance test for the 1981-2003 being different from (warmer than) the "population" formed from the 1901-1979 period for both months.

Q: Is the warming significant at 95% confidence?

How much of the warming is due to urban growth of the Phoenix area, surrounding "Sky Harbor International Airport" where the temperatures were taken? To try to find the answer to this, examine temperatures at Yuma, Arizona -- a small town in the same part of the U.S. but 150 miles west, "in the middle of nowhere".

Q: Is there still a positive difference in temperature between 1981-2003 and the reference period of 1901-

Lab 4

1979 for January and/or July? Is it significant?

If it is no longer statistically significant, try the same statistical test but for the annual average of the mean temperatures over all months of the year. To do this....

Project 3: Repeat the same analysis but for three sites in the New York region: Central Park (urban), Scarsdale (suburban), and West Point (rural, 50 miles north but in same region) to answer the following questions:

- Is there a significant warming trend at these sites?
- Are the trends significantly different between the three sites?
- Do you think that it is due to urbanization?