When you analyze some data-based paper/study, here are some suggestions about points to consider. I will probably revise this list based on your analyses during the semester.

General points

Here are some general suggestions for analyzing a scientific study.

- *Summarize.* Understand what exactly the authors' intentions are, what they do, and what their conclusions are. Begin your analysis with a summary of the authors' claims. Note what they state as uncertainties/limitations of their study?

- *Determine type of study.* The two main types of studies are exploratory and hypothesis-driven. Exploratory studies are one where investigators just start with an open-ended question, do some experiments, and try to interpret the results. Here the results do not validate any specific hypothesis, but may suggest a hypothesis to test in a future study. Hypothesis-driven studies are ones where you start of with a specific hypothesis and can do a statistical test to see if there is evidence for or against it, and one often talks about statistical significance or confidence intervals (which make less sense for exploratory studies).

- *Evaluate experimental design.* Understand the design of the experiment and whether it makes sense, or seems to have inherent bias.

- *Evaluate quantitative results.* What are the issues in the quantitative methods? E.g., do they assume normal distributions when they shouldn't or assume a sample is random when it is clearly biased?

- *Evaluate conclusions.* Usually some conclusions (sometimes quite tentative, sometimes less so) are drawn based on the quantitative results. Often the desired object of the study (e.g., influence) is not exactly the same as what their data is measuring (e.g., citations). Understand the difference between these things and to what extent one can reasonably make conclusions about one from the other. Are their conclusions reasonable based on their analysis?

  Or even if there are flaws in the quantitative analysis, are the conclusions still reasonable based on the data? Just because a study may have flaw/limitations (e.g., assumptions may not be totally realistic, or the sample is not completely random), does not mean one should ignore all conclusions—all studies have some limitations. It may still provide still partial evidence for the authors' conclusions, and your job is to determine how much. (All non-fabricated data says something, the question is what.)

- *Separate content and presentation.* Papers/reports may be quantitatively sound, but written too poorly for you to judge the analysis, or vice versa. Try to critique these separately. (E.g., many fields have writing conventions you may not be aware of, so what is left unsaid may be clear to experts but not to you. Though you may have to conclude that not enough was explained to evaluate a certain facet of the analysis.)

More specific considerations

Here are some more specific concerns that are common issues/concerns. Depending on the study, only some of these will make sense to consider in your analysis.

1. Are their any obvious biases of the authors (e.g., a doctor employed by a tobacco company reporting on the health effects of smoking)?
2. What are the assumptions in the model? Are they assuming certain variables or factors are independent? How reasonable are the assumptions?
3. Analyze the authors' sample set. Is it too small? How representative is it? (Even relatively small sample sizes can be very informative, if the sample is good. Here is a sample size calculator: http://www.nss.gov.au/nss/home.nsf/pages/Sample+size+calculator) Is it likely the choice of sample biased the results? (Note in some cases it may be very hard to get a good random sample.)
4. Are the findings statistically significant? This depends on various things, such as the the variance in the distribution and the sample size.
5. What was the likelihood of false positives in this study?
6. Is the data obtained reliable? (E.g., surveys can be very biased based on the way questions are formulated, or may elicit dishonest responses.)
7. Are uncertainties in the data ignored?
8. Were just averages reported with no mention of the distribution?
9. For assertions of "new correlations," were there reasons to expect these correlations in advance? Is there evidence that they are not just spurious correlations?
10. Was there any cherry-picking of data or measurement methods?