Best Practices Guide for Satisfactory Research

* Advisor and advisee should agree upon several goals for the semester that could ideally be completed in parallel. Some goals may be ambitious, but a clear minimum level of achievement that constitutes satisfactory research should be agreed upon. The goals should include or align with satisfactory progress towards the degree (proposal, qualifying exam, 5 dissertation defense).

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| Major Goals | Anticipated completion date |
| 1. Study the normality test literature and come up with a short list of methods worth exploring. |  |
| 1. Complete the simulation studies to assess the utility of the normality tests. This can be done parallelly with 1. |  |
| 1. Gain insights on the results of the simulations, perhaps use some analytical approaches. |  |
| 1. This is a follow up of 1: Assess the short-listed methods. |  |
| 1. This is a follow up of 2: Start working towards a generic pipeline for a user interested in similar assessment for any normality test and downstream test |  |

I \_\_\_\_\_\_\_\_\_\_ agree that I must \_\_complete at least 1,2, and 3\_\_\_\_\_ to earn a grade of SR.

* Advisees are encouraged to keep a brief weekly or monthly log that outlines weekly/monthly assigned objectives and outcomes, and have the log signed by advisor.

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| Week | Assigned objective for this week | Outcome | For next week |
| 1 |  |  |  |
| 2 |  |  | We discussed the major goals going forward.  The goal for next week is to run some simulations with the power loss defined in a different way using permutation test approach. |
| 3 | Run some simulations with the power loss defined in a different way using permutation test approach. | Good start towards understanding permutation tests but the simulation structure needs some more work. | Continue working on permutation test-based simulation.  Try to think how to run a permutation-based one sample t-test |
| 4 | Continue working on permutation test-based simulation.  Try to think how to run a permutation-based one sample t-test | Improved simulations but results not quite correct. | Keep working on improving the simulation results.  Read and possibly add the one sample permutation test. |
| 5 | Keep working on improving the simulation results.  Read and possibly add the one sample permutation test | Simulation test codes well debugged | -use different effect sizes. Add uniform distribution, drop asymmetric distributions in one sample case, and add some smaller sample sizes.  - Calculate Type I error probabilities and inflation of Type I error rates |
| 6 | -use different effect sizes. Add uniform distribution, drop asymmetric distributions in one sample case, and add some smaller sample sizes.  - Calculate Type I error probabilities and inflation of Type I error rates | Got some promising results from simulations. I made the necessary changes as recommended with a few things to get it right. | Make plots of the results of the power of normality test, power loss of downstream test, and inflation of Type I error probabilities  Fix error in formula in contaminated distribution simulation.  Change effect sizes and sample sizes appropriately |
| 7 | Make plots of the results of the power of normality test, power loss of downstream test, and inflation of Type I error probabilities.  Fix error in formula in contaminated distribution simulation.  Change effect sizes and sample sizes appropriately | Plotted results, but very easy to visually interpret.  Fixed issue with contaminated distribution  Effect size and sample sizes adjusted appropriately. | Use different lines for power and power loss plots for easy interpretation.  Maybe one plot for each distribution, better still one plot ontop the other suing same x-axis  Increase iteration size to say 10,000.  Justify the variance of the contaminated distribution analytically |
| 8 | Use different lines for power and power loss plots for easy interpretation.  Maybe one plot for each distribution, better still one plot on top the other suing same x-axis  Increase iteration size to say 10,000.  Justify the variance of the contaminated distribution analytically | Plots fixed. I could not put two plots on top of each other as suggested.  Job submitted to supercomputer did not finish running. | Finalize the simulation test. Make necessary corrections to the codes.  Plot the downstream test and normality test together. Plot the powerless of the downstream test and normality test together. Add Type I error rates for the two-sample case |
| 9 | Finalize the simulation test. Make necessary corrections to the codes.  Plot the downstream test and normality test together. Plot the powerless of the downstream test and normality test together. Add Type I error rates for the two-sample case | Plots of power loss function adjusted; one distribution per plot.  One sample case not completed. | Quantify utility of normality  Derive mathematical expected power loss function.  Consider ROC AUC curve |
| 10 | SPRING BREAK | | |
| 11 |  | Benedict completed the type-I error inflation results, but they looked somewhat strange (always getting negative type-I error inflation when compared to permutation test). | (i) figure out why this is happening (try known cases, try digging deep, rechecking codes)  (ii) define the inflation of type-I error by comparing with the target level, and include the asymmetric distributions too  (iii) calculate the expected power loss (also start writing up how you are doing so)  (iv) keep reading papers for lit review, put your own comments, and get a good idea about the big picture |
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| 15 |  |  |  |

Characteristics of a good advisee are below

* + Always on time and well prepared for each meeting. Schedules meetings with advisor.
  + Shows initiative – does research beyond expected (reads extra articles, runs a simulation study to debug, etc).
  + Learns from mistakes
  + Has a positive attitude
  + Self-aware (some examples below). “Know what you know and know what you don’t know”
    1. Good: “This method can’t be applied here or this theorem isn’t true because ….[proof or counter example provided]”
    2. Good: “I’m not sure if this method can be applied or if this theorem is true because I haven’t been able to verify the third equality in the proof of line 3
    3. Good: I’m not able to get output from the M step in the algorithm yet. Data inputted needs processed differently. I’m reading the help file and vignette”
    4. Good: “I can see that you don’t follow my reasoning for this. Let me work on improving my communication and get back to you.”
    5. Poor: This method can’t be applied here or this theorem isn’t true because there are bugs in the code
    6. Poor: This theorem can’t be true: I can’t verify the proof.