

## Writing About Operations Research – Experiment Setup, Results, and Conclusion

### 1 The experiment setup section

- The purpose of this section is to tell your reader how you ran/solved your model.
- Suggested outline:
  - In one paragraph, describe
    - ◊ the software you used to run/solve your model, and
    - ◊ your computing environment (i.e., operating system, CPU type and speed, amount of RAM)
  - In the next paragraph, describe the different variants of the model you ran/solved.
    - ◊ For **optimization models**: the instances (i.e. variations of input data) you solved.
    - ◊ For **statistical models**: the combinations of dependent and independent variables you considered.
    - ◊ For **simulation models**: the alternatives you tested, and the number of replications for each alternative.
  - If you created a **user interface** for your model, in another paragraph:
    - ◊ Describe the programming languages and software you used to create the user interface.
    - ◊ Describe how your target user will use your interface, step-by-step. Include screenshots.

### 2 The results section

- The goal here is to tell your reader about your awesome results.
- The way you need to write about this depends on the type of model you ran/solved.
- For **optimization models**:
  - Report the running times for each instance:
    - ◊ how long it took to solve the model, if you solved it to optimality, or
    - ◊ how long you let the solver run, if you did not solve the model to optimality
  - Report any performance metrics of interest for each instance. Often, this is the objective function value.
  - Display the solution you found in a user-friendly format for each instance.
    - ◊ e.g. a timetable for a schedule, a table of stops for a route.
  - Interpret the solutions you found. Do they make sense? Why or why not? Do they have any interesting or surprising features?

- For **statistical models** (in particular, regression models):
  - Report the coefficients, associated  $p$ -values, and goodness-of-fit statistics (e.g.  $R^2$ , AIC, BIC) for each model in a table.
    - ◇ You can report all models in a single table, or put the results into separate tables.
  - Describe what the  $p$ -values and goodness-of-fit statistics mean.
  - Interpret the coefficients.
    - ◇ Your interpretation should reflect whether your project seeks an **explanatory** or **predictive** answer.
    - ◇ Explanatory: discovering the underlying relationships in the data, e.g.:
 

Does exercising 30 minutes a day lead to lower blood pressure?
    - ◇ Predictive: using existing data to determine unknown quantities, e.g.:
 

If I were to exercise 1 hour per day, what will my blood pressure be?
  - Discuss how your results are generalizable and not generalizable.
- For **simulation models**:
  - Report the sample mean of the performance measures and the associated confidence intervals for each scenario in tables.
  - Interpret your results. Discuss any interesting trends or trade-offs in the simulation output.
- Some general guidelines:
  - You should introduce every table or graph to your reader with some text, e.g.
 

The graph below shows the average delay predicted by our simulation for different numbers of baristas working in the cafe.
  - Give your tables and graphs descriptive captions.
  - Give your table columns descriptive titles.
  - Label the axes of your graphs.

### 3 The conclusion

- The purpose of the conclusion is to (i) summarize your report for the reader, and (ii) provide directions for future work.
- Suggested outline:
  - In one paragraph, summarize your project:
    - ◊ Give a brief description of your problem.
    - ◊ Describe your methodology.
    - ◊ Discuss the key takeaways from your results.
  - In one to two paragraphs, describe the limitations of your work and provide directions for future work. For example,
    - ◊ Did you make any assumptions that you wish you could relax? What are these assumptions? What would change about your project if you relaxed them?
    - ◊ Is your project only part of a larger problem?
    - ◊ What would you do next if you had more time?
    - ◊ One way of thinking about this: provide future generations of midshipmen directions on how to build upon the work you did this semester.