Operations Research applications: Six Sentence Abstract

1. The *introduction* presents the topic of the 6SA. It guides the reader to the decision or prediction situation of the case.

2. The *model* states which mathematical methods are used to analyze the data and make any recommendations. If the model is optimization include the objective and constraints; if the model is simulation describe the input parameters to set and the output metrics of concern; if the model is decision analysis state the key forks in the diagram, et cetera.

3. The *data* are all of the numerical quantities needed to run the model, like probabilities, counts of customers, lists of each nurse's schedule preferences, prices of raw materials and labor, or contact network graphs showing which individuals interact. Describe what data are used as input and where they are obtained: public data, business records, invented records.

4. The *results* are the numbers produced as an output of the analysis performed. These are the quantities that we did not know before the operations research techniques were applied, but that we know now. Results are sometimes qualitative instead.

5. The *recommendation* provides an answer to the decision-maker, for example, surgery scheduling should proceed on a shortest-case-first heuristic, or 12 nurses should be hired, or the evacuation should proceed along the routes in the map in Figure 3.

6. The *limitations* are the aspects of the decision problem that are not completely captured or accurately represented in the model, or are elements of the work that should be expanded as the project continues.

Examples:

Bike-sharing operators must plan to rebalance the stations by moving some bikes from one station to another, and so Liu et al. predicted hourly demand of bikes picked up and dropped off at each station. Pickup demand was predicted using meteorology-similarity-weighted K-nearest-neighbors method and dropoff demand was predicted using an interstation bike transition model for the distribution of the bike ride times. Data was the historical pickup and dropoff numbers of bikes, along with meteorology (weather) data from each of those days. The pickup demand prediction shows how many bikes will be picked up in each hour of the 24-hour day, and the interstation bike transition model discovered two types of riders, tourists and commuters, that determine when the bikes will be dropped off. The pickup and dropoff demands should be used as inputs to another optimization model to plan how vehicles can move the bikes to rebalance the stations. Collecting more days of data would make the model more accurate.

Opioid addiction can be treated at methadone clinics, but the clinics must be near the patients because patients make daily visits to the clinic. Bonifonte and Garcia used an integer programming model to decide which k clinics to open to maximize number of new patients served and minimize total travel distance for all clients. The input data are locations of existing and possible new clinics, plus the numbers of patients served and unserved in each census tract in Indiana, Kentucky, Ohio, Tennessee, and West Virginia. Results show that if serving new patients is most important, then the new clinic(s) will be located in current service deserts. Decision makers should clarify the tradeoff between reaching new clients and minimizing travel distance. This model did not consider actual driving times but used straight-line (Euclidean) distance instead.

Evaluation criteria for six sentence abstracts:

Precondition: Sentence has 30 words or less and is clearly comprehensible. If the sentence does not make sense it scores zero points.

1. *Introduction*

   1. The introduction clearly states the decision situation.
      Can you answer: What is the model about?

   2. The introduction makes clear who would be interested and why.
      Can you answer: Who asked for this model to be built?

2. *Model*

   1. The model is a mathematical method that you have learned about in SMO.
      Can you answer: What course(s) would you have studied this or a related method?

   2. The model is clearly and concretely specified for this particular problem.
      Can you answer: What is the objective to be optimized, or the number to be predicted?

3. *Data*

   1. The input data are quantities that you can measure.
      Can you answer: Are these integers or rationals and what are their units?

   2. The input data are appropriate for the method specified in *model*, and can be known or estimated at the start of the project.
      Can you answer: How were these data measured, collected, or estimated?

4. *Results*

   1. The quantities or qualities of the output of the model are described in the sentence.
      Can you answer: Were these results obtained after doing some computation or analysis?

   2. The results are appropriate to the goal specified in the introduction.
      Can you answer: How is this related to the decision problem in the introduction?

5. *Recommendation*

   1. The sentence tells the decision-maker what action is recommended.
      Can you answer: What should decision-maker do with these results?

   2. The recommended action is within the control of the decision-maker.
      Can you answer: Can the decision-maker take this action?

6. *Limitations*

   1. The limitations (that is, the caveats) of the model are described in the sentence.
      Can you answer: How is this model less accurate than reality, or less helpful than it could be?

   2. The limitations help me better understand whether I should trust the recommendation.
      Can you answer: How do we expand the current study, or why is the study good enough as is?

1. *If the language is not perfect, try to understand what the writer is trying to say as best as you can. If something is vague, write in your comments what you think the sentence is trying to say, and score it. If the sentence is incomprehensible, assign zero points, and explain why you cannot comprehend the sentence.
2. Each sentence is evaluated first against a formal criterion and then against a quality criterion. Award the first point when a sentence fulfills its formal function in the abstract, as specified in the first criterion. If fulfilled, you can award a second point for the quality with which the sentence performs this function, as specified in the second criterion.
3. Each sentence is graded on its own. Mistakes or shortcomings in one sentence should not affect the grading of another sentence. For instance, if you do not accept the *model* (#2), a well-written *recommendation* (#5) can still earn full marks.
4. The quality criterion for the *introduction*, *model, data, results*, and *recommendation* require that those statements be connected in a comprehensible way. As a reviewer, you must judge whether the connection and chain of reasoning is understandable. If these things do not seem to connect, you need to explain why.
5. Note that the *model* (#2) must be one that could yield the output in the *results* (#4), and that the *recommendation* (#5) must be of the type that matches the modeling choice.