

# Quantitative Methods in Systems Engineering

## *Project Scoring Rubric*

### WEEK 1: MAKING EARLY TRADEOFF DECISIONS

Criterion	Step 1: Define the study objectives
<b>Prompt</b>	Before beginning a study, it is essential to fully define your study and its objectives. You are the study lead. You may want to identify one or more experts who you can consult with.
<b>Points</b>	
3	<b>Complete:</b> All the seven fields (Title, Study Lead, Objective, Targeted Decision, Team, Assumptions, and Relationships) properly identified. The write up is logical, complete and easy to understand.
2	<b>Partially Complete:</b> Not all seven fields identified. However, three or more identified.
1	<b>Incomplete:</b> Only one or two fields identified.
0	<b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.

Criterion	Step 2: Set up tradeoff study
<b>Prompt</b>	<p>Given your system of interest and study objective, you will determine selection criteria (measures by which alternatives will be compared) and assign weighting to the selection criteria. Specify three effectiveness/performance measures and one measure related to cost. You will also specify the value ranges for each of the selection criteria using a 1-2-3 scoring scale, where 3 is “best” (e.g., best performance is 3, least cost is 3). Use the template below to record the information, including any notes and rationale. Enter study name in first row of table.</p> <ol style="list-style-type: none"> <li><i>Did you identify three effectiveness/performance measures and one measure related to cost?</i></li> <li><i>Did you describe all the performance measures?</i></li> <li><i>Did you specify the value ranges for each of the selection criteria using a 1-2-3 scoring scale?</i></li> <li><i>Did you assign weights to the performance measures?</i></li> <li><i>Did you enter the study name in the first row of table?</i></li> </ol>
<b>Points</b>	
3	<b>Complete:</b> All criteria as specified in the prompt are complete.
2	<b>Partially Complete:</b> Three to four of the criteria are complete.
1	<b>Incomplete:</b> One to two of the criteria are complete.
0	<b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.

Criterion	Step 3: Generate/identify alternatives and gather data
Prompt	<p>Now that you have set up your study, you should generate your alternative concepts (these could be newly defined concepts and/or existing alternatives you identify). You may use your own knowledge, brainstorming, expert advice, literature, marketing info, and other information. These should be high-level concepts. Identify four concepts. List the concepts by a unique name or another unique identifier. For each alternative, gather performance and cost data for each of the selection criteria (if not available, you can estimate these for this exercise). Record your information in the template, documenting how you decided on these concepts and any other notes.</p> <ol style="list-style-type: none"> <li><i>1. Did you identify four high level concepts and assign an individual unique name/identifier for them?</i></li> <li><i>2. Did you identify the performance and cost data for each?</i></li> <li><i>3. Did you assign resultant scores to the concepts?</i></li> <li><i>4. Did you document how you decided on the concepts and their resultant scores?</i></li> </ol>
Points	
3	<b>Complete:</b> All criteria as specified in the prompt are complete.
2	<b>Partially Complete:</b> Two to three of the criteria are complete.
1	<b>Incomplete:</b> Less than two of the criteria are complete.
0	<b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.

Criterion	Step 4: Perform analysis
Prompt	<p>Using the decision matrix template (which will be populated with information from steps 2 and 3), apply scoring scale to each of the alternatives against the selection criteria based on its performance and cost measure information (scoring it a 1, 2 or 3). The score you enter will be multiplied by the weight, and the resulting calculated value will appear. The last row of the matrix will calculate a normalized total by summing the weighted scores and dividing by the number of selection criteria (4), rounded to two decimal places. Examine your matrix and determine which score(s) are the highest, and how the scored concepts compare. Record your observations in the matrix – does this result match your expectations?</p> <ol style="list-style-type: none"> <li><i>1. Did you ensure that all the information is logical and correct?</i></li> <li><i>2. Did you examine your matrix and determine which score(s) are the highest, and how the scored concepts compare?</i></li> <li><i>3. Did you record your observations on the results and if they match your expectations?</i></li> </ol>
Points	
3	<b>Complete:</b> All criteria as specified in the prompt are complete.
2	<b>Partially Complete:</b> Two of the criteria are complete.
1	<b>Incomplete:</b> Only one of the criteria is complete.
0	<b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.

Criterion	Step 5: Perform sensitivity analysis #1
Prompt	<p>In this step, you will perform a sensitivity analysis. Change the weights of one of your selection criteria by reducing it by 0.05 and increase another one of the selection criteria weights by the same amount. Observe what happens and add to the prior comment in the observations block of the matrix.</p> <ol style="list-style-type: none"> <li><i>1. Did you change the weights of one of your selection criteria by reducing it by 0.05 and increase another one of the selection criteria weights by the same and ensure that all the information is correct?</i></li> <li><i>2. Did you examine your matrix and determine which score(s) are the highest, and how the scored concepts compare?</i></li> <li><i>3. Did you record your observations on the results and if they match your expectations?</i></li> </ol>
Points	
3	<p><b>Complete:</b> All criteria as specified in the prompt are complete.</p>
2	<p><b>Partially Complete:</b> Two of the criteria are complete.</p>
1	<p><b>Incomplete:</b> Only one of the criteria is complete.</p>
0	<p><b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.</p>

Criterion	Step 6: Perform sensitivity analysis #2
<b>Prompt</b>	<p>In this step, you will perform another sensitivity analysis. Suppose cost became the driving factor over all others. Change the weight of your cost criterion to 0.7, and change the weight for each of the three other criteria to 0.1. Observe what happens and add to the prior comments in the observations block of the matrix.</p> <ol style="list-style-type: none"> <li><i>1. Did you change the weight of your cost criterion to 0.7, and change the weight for each of the three other criteria to 0.1 and ensure that all the information is correct?</i></li> <li><i>2. Did you examine your matrix and determine which score(s) are the highest, and how the scored concepts compare?</i></li> <li><i>3. Did you record your observations on the results and if they match your expectations?</i></li> </ol>
<b>Points</b>	
3	<b>Complete:</b> All criteria as specified in the prompt are complete.
2	<b>Partially Complete:</b> Two of the criteria are complete.
1	<b>Incomplete:</b> Only one of the criteria is complete.
0	<b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.

Criterion	Step 7: Make final recommendation and document your study
Prompt	Given the study objective and the results of your analysis, what do you recommend? Document the process you used in your study and your recommendation in the table below, including any reflections that may help in communicating the study.
Points	
3	<b>Complete:</b> All the fields properly identified. The write up is logical, complete and easy to understand.
2	<b>Partially Complete:</b> Some fields may be missing but majority of the fields identified.
1	<b>Incomplete:</b> Majority of the fields are missing (only < 50% of the fields identified).
0	<b>Not Attempted:</b> The project template is without work, in its original state. Sample project is copied for submission.