Lab 2: Scheduling House Building Tasks Using Decision Optimization Model Assistant for Watson Studio

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Author: Fabio Lima fabiofl@br.ibm.com

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Overview

This Lab exercise will guide you on how to use Decision Optimization Model Assistant in creating planning scenarios on Watson Studio to efficiently assign construction tasks to workers of different skill levels. You will learn how to:

- Load data
- Create multiple planning scenarios
- Manipulate Objectives & Constraints

The Business Problem

This is a problem of building a house; the masonry, roofing, painting, etc. must be scheduled. Some tasks must necessarily take place before others and these requirements are expressed through precedence constraints.

There are three workers, and each worker has a given skill level for each task. Each task requires one worker; the worker assigned must have a non-null skill level for the task. A worker can be assigned to only one task at a time.

The objective is to maximize the skill levels of the workers assigned to the tasks.

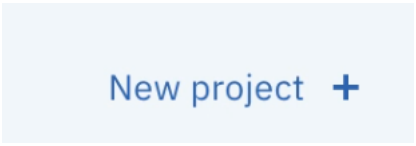
Part 1: Set up a Project

In this section we will set up a WS Local Project. The Project is a high level container where all assets are stored or referenced.

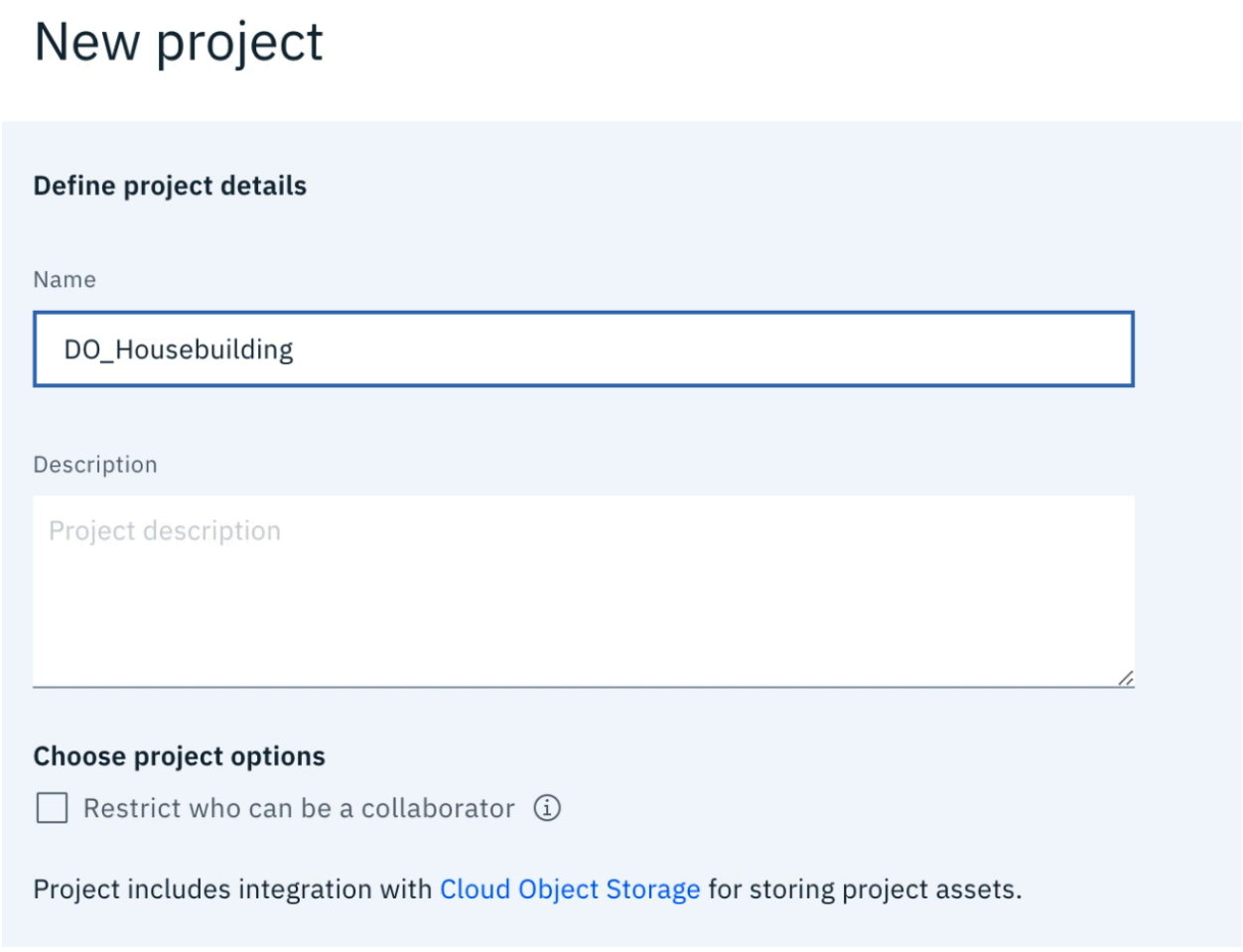
1. Login WS Local

   NOTE: YOU CAN USE THE PROJECT CREATED IN LAB 1
   AND SKIP TO STEP 4.

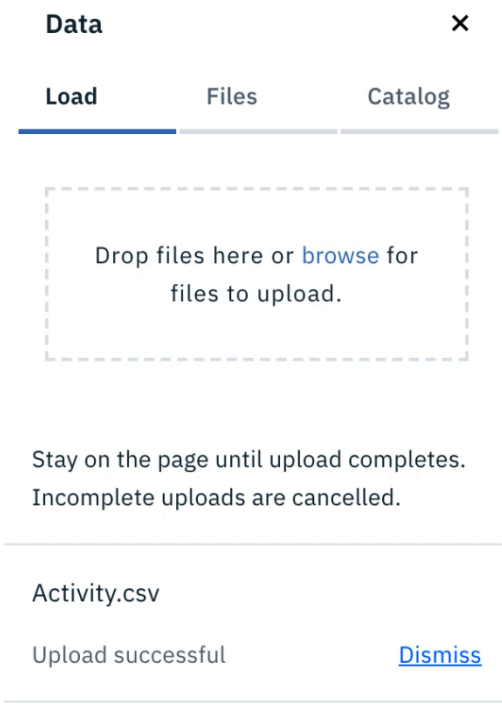
2. (Optional) Once in the *Community* page, click on the little plus (+) sign on the top right of the screen and select *Create Project*. →



3. Enter a project name (i.e. "Housebuilding_DODS") and a brief description. Click *Create*.



4. Let's now load the required data files. The Data Panel should be open (below). If not, click on the  icon to display it.

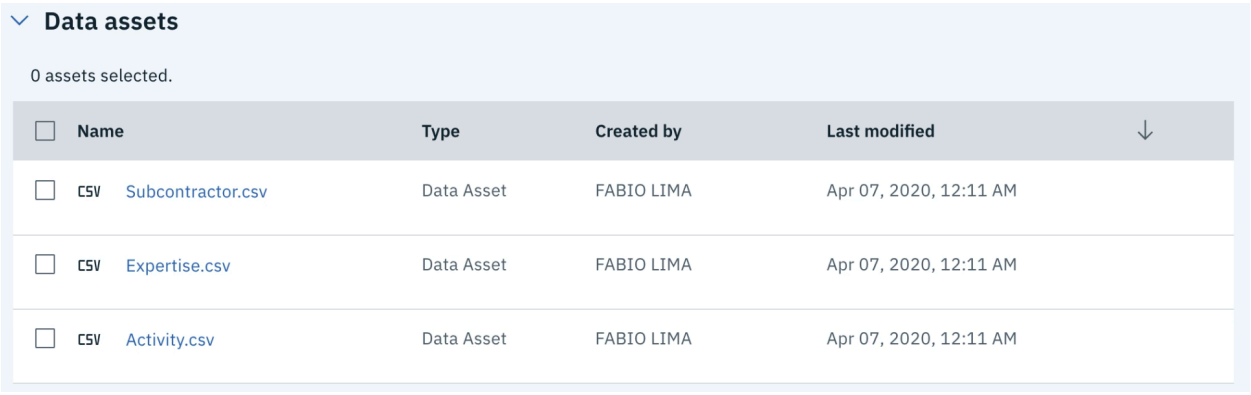


1. Click browse or drag n drop the 3 CSV files (Activity, Expertise, and Subcontractor) on to the Panel area.

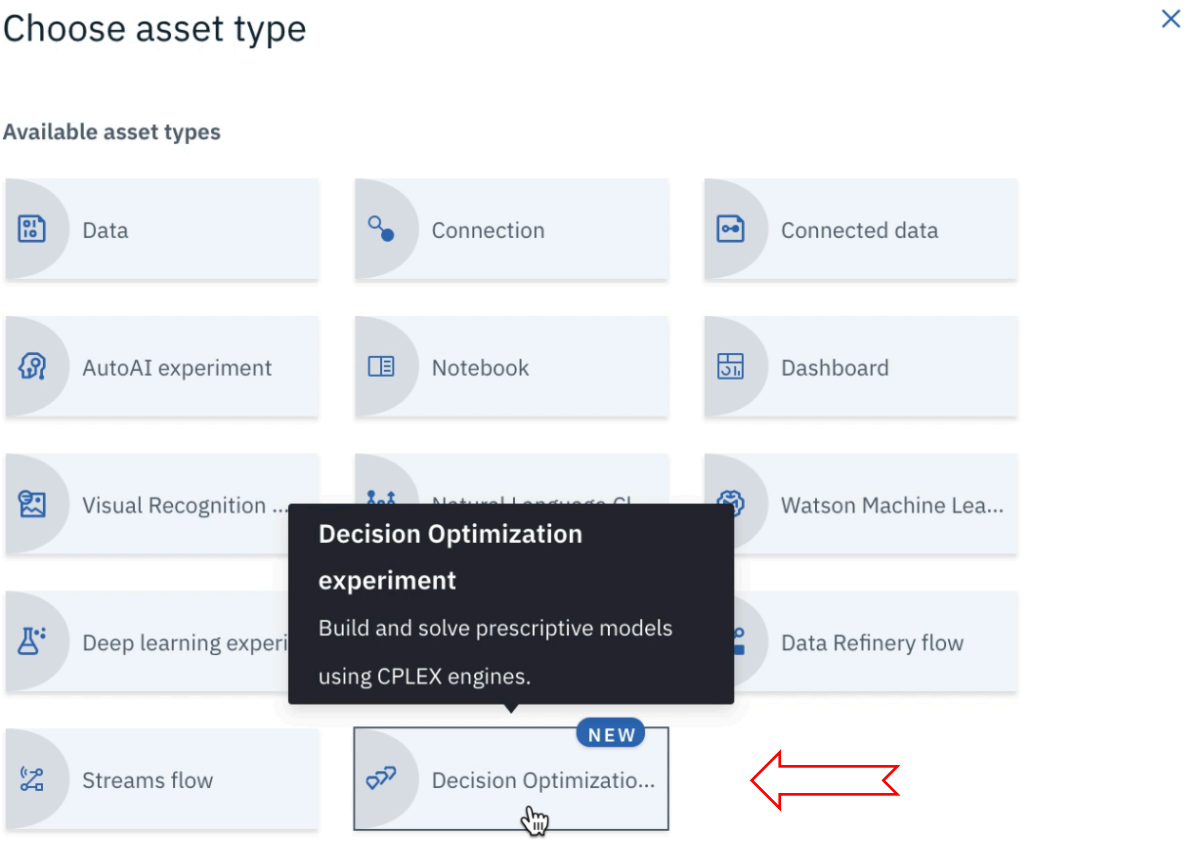
← Data Panel with all 3 files loaded.

2. Import all three files into the area "Drop files here"

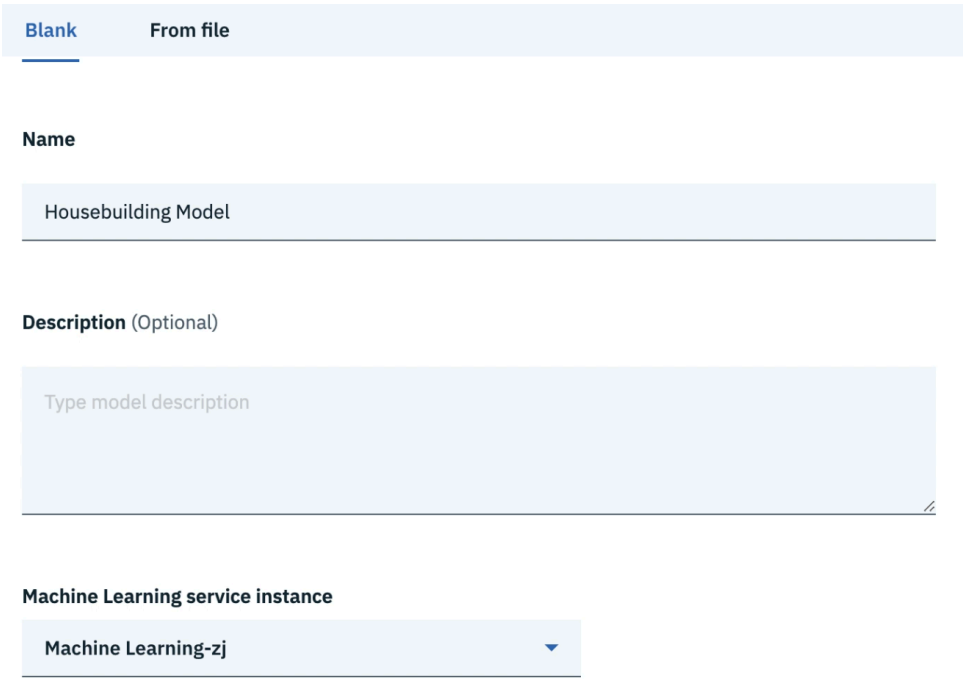
3. Browse the data files displayed on the center area.



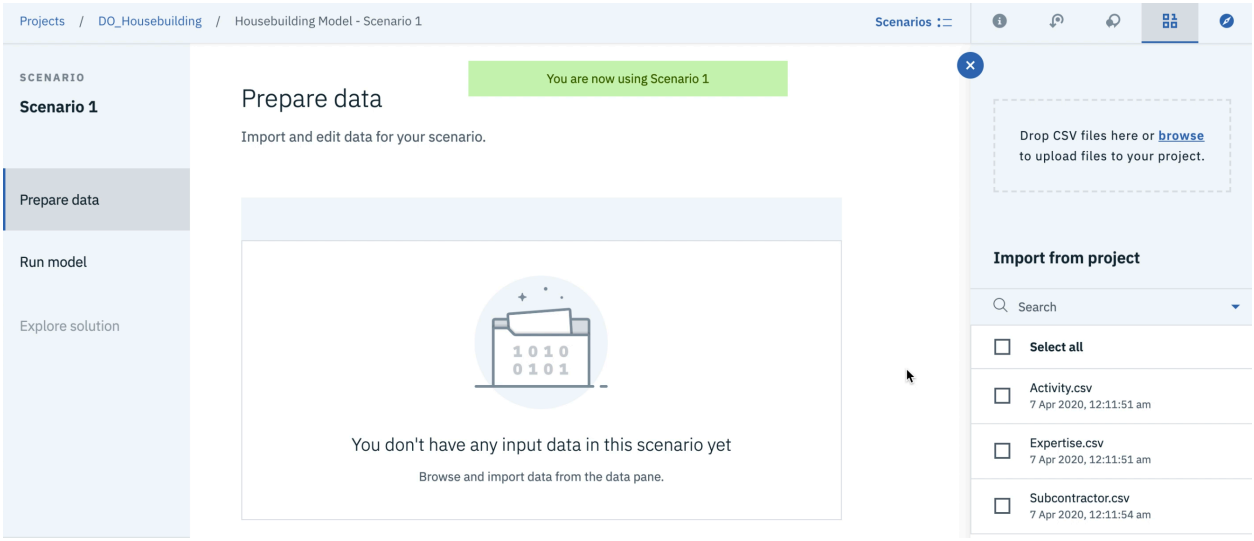
5. On the Project Dashboard, click on the Add to Project sign at the top right side of the screen and *Add* a Decision Optimization experiment.


Choose asset type
Available asset types
Data
Connection
Connected data
AutoAI experiment
Notebook
Dashboard
Visual Recognition ...
Watson Machine Lea...
Deep learning experi
Data Refinery flow
Streams flow
NEW
Decision Optimizatio...
Decision Optimization experiment
Build and solve prescriptive models using CPLEX engines.

6. Enter a Name and (optional) brief description. Select the Machine Learning service instance. Click *Create*



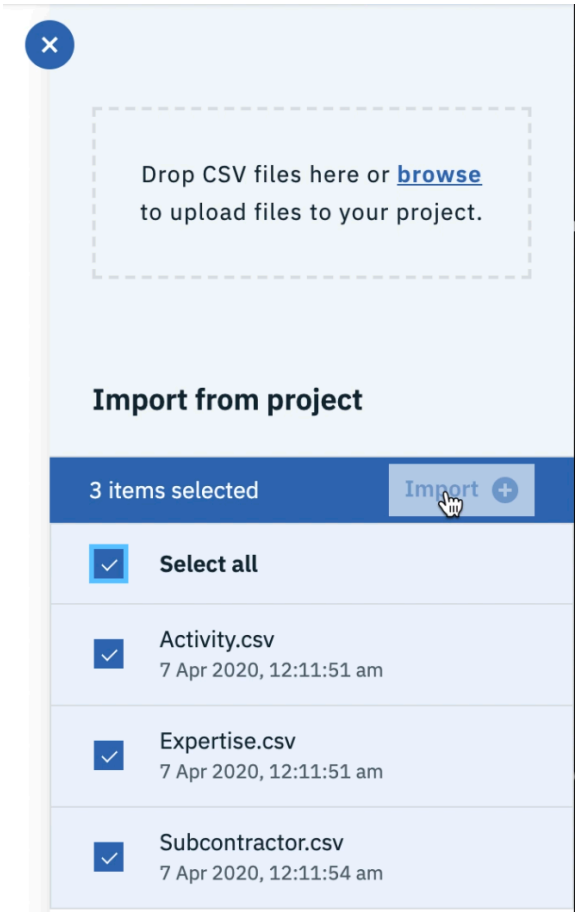
The workspace will display



Part 2: Loading Data to the model

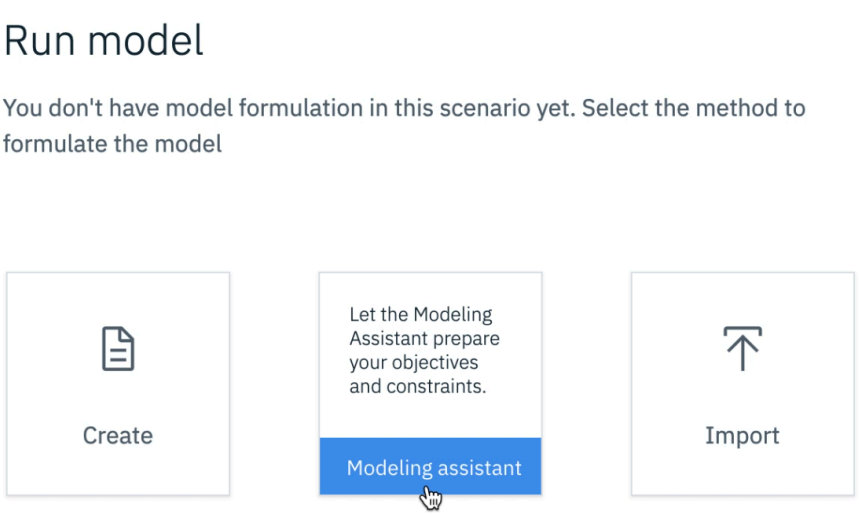
Let's now load the required data files to the model.

Select the 3 CSV files (Activity, Expertise, and Subcontractor) on to the Panel area and click Import.

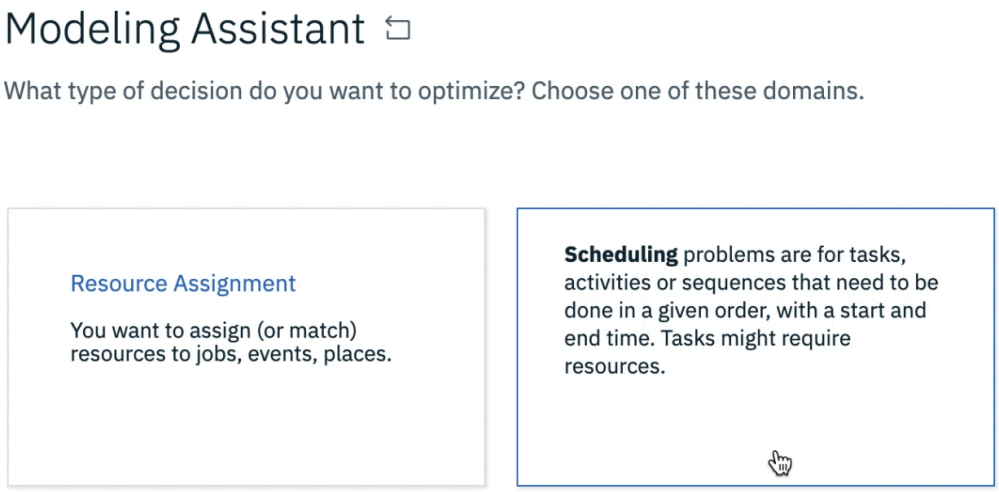


Part 3: Running the Model

1. Click on Run Model to start formulating the model. Select "Modeling assistant".

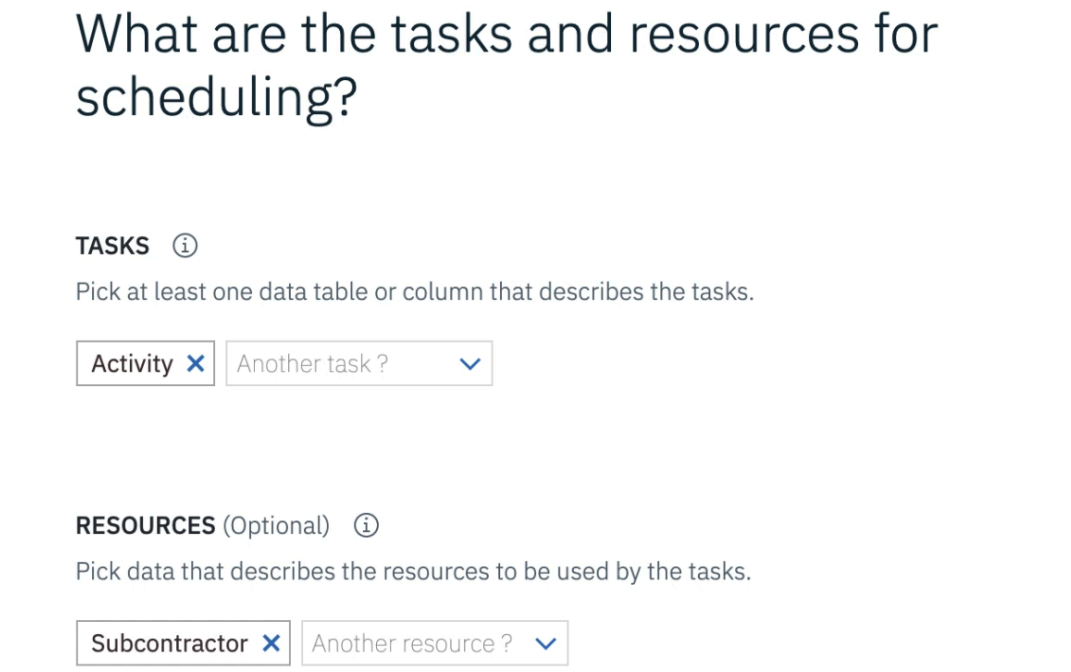


2. Select the "Scheduling" domain



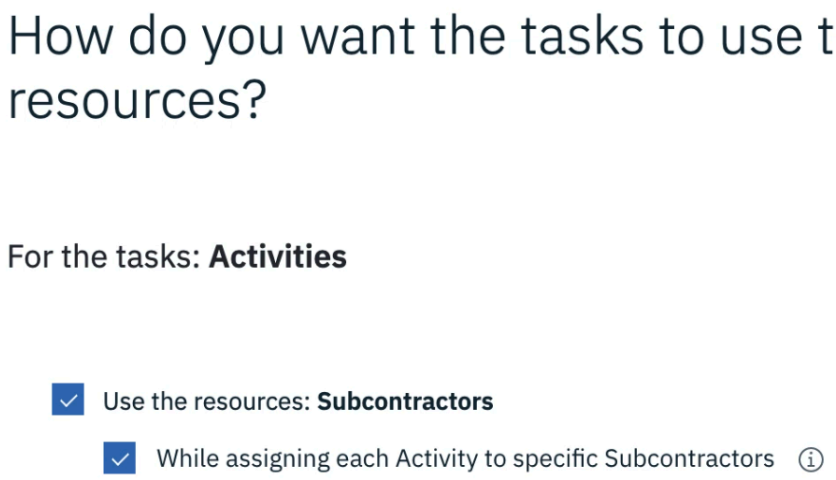
3. Now, let's select the Tasks and Resources

- Map a task, choose: Activity
- Map a resource, choose: Subcontractor

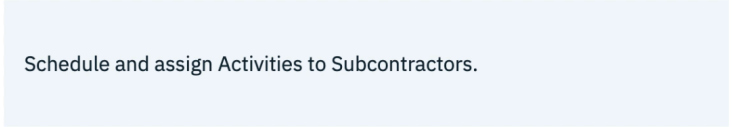


Click *Continue.*

4. Make sure to leave both boxes checked and click *Continue*

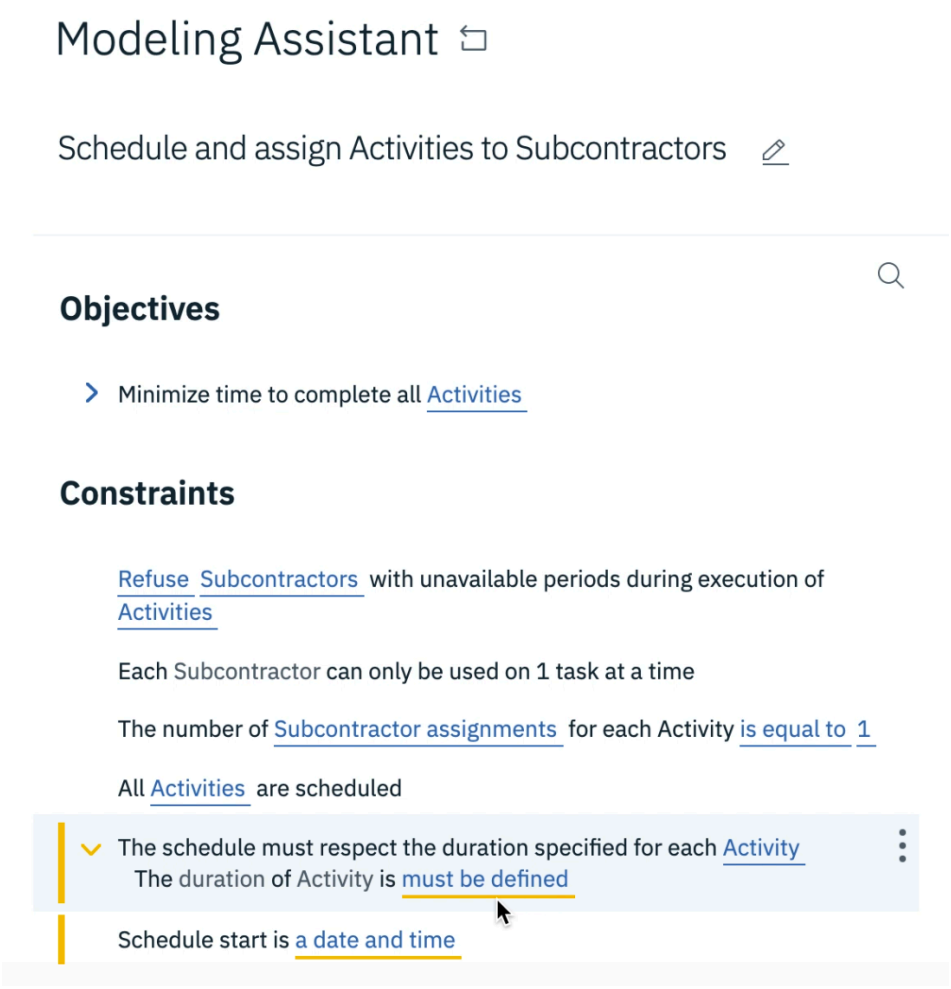


5. Click *Finish* to validate the intent.

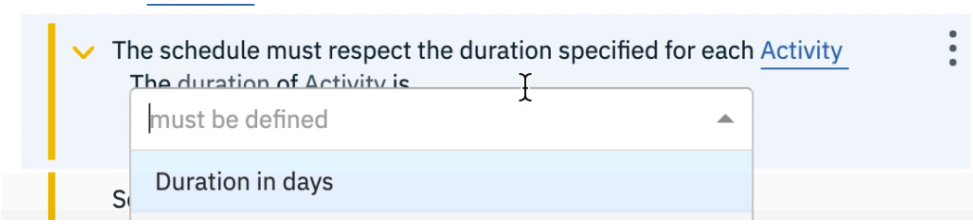


6. Take a few minutes to examine the *Model* page. Locate the Objectives & Constraints section on the left pane. Notice that some rules are preselected but others require completion (marked by a vertical red bar).

   On this example, we'll need to define a Start date and the Duration



   a. Click on the red arrow > to display the definition. Click on the default selection – Duration in days – to examine the other options. Keep "Duration in days" as the choice.



   b. click the red <a start date> placeholder to select a start date. Enter a new date as text, for example: 2020/15/06 00:00:00 or select a date from the proposed list. (i.e. today's date).

c. Let's add precedence constraints.
Under the Suggestions tab, type some Natural Language text, such as "after preceding activities" and click enter to get suggestions.

Look at suggestions and click on the plus sign ⊕ to add the constraint: "Each Activity starts after the end of preceding activities"

d. Adding a compatibility constraint

Enter some Natural Language text such as "*subcontractor is included in possible subcontractors*"

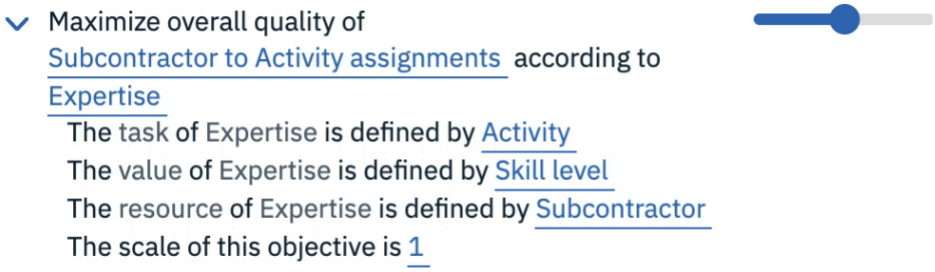
Look at suggestions and click on the plus sign ⊕ to add the constraint: "For each Subcontractor to Activity assignment, assigned Subcontractor must be one of Possible Subcontractors of Activity"

e. Add another objective

Enter some Natural Language text such as "overall quality"
And add from suggestions the "*Maximize overall quality of Subcontractor to Activity assignments according to < table of assignment value >*"

Click on <table of assignment value> to edit it and select (or type) *Expertise*

Click on The Value of Expertise <must be define> to edit it and select (or type) *Skill level*



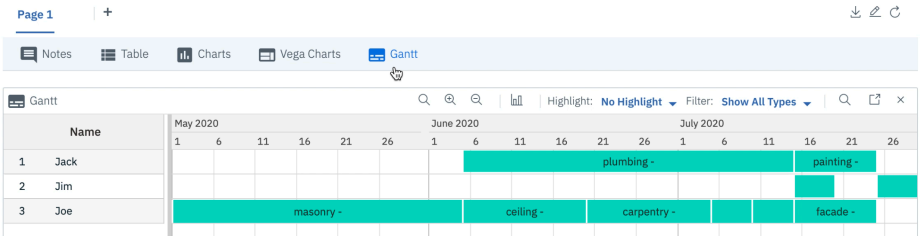
Your new objective is: *Maximize overall quality of scheduling assignments according to Expertise*

f. Click on to Run model.

g. Take a few minutes to examine the *Solution* page.

h. Select Visialization and select Gantt Chart to view the construction schedule.

Visualization



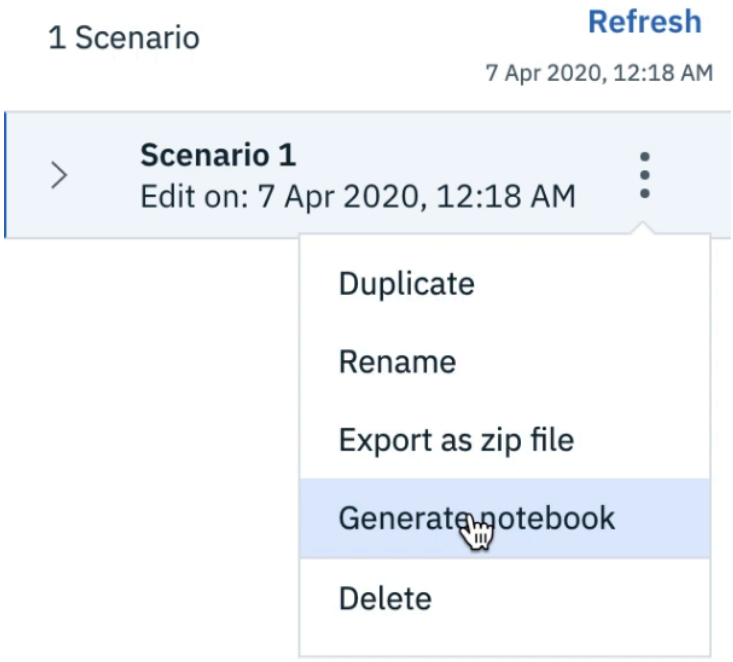
CONGRATULATIONS!
You have successfully completed the DODS Housebuilding Lab.

Bonus Section: Exporting the Model

Now that the model is built and trained, let's export it to a Notebook and examine it closely.

1. Open the Scenario Panel 

, click on the 3 dots and select *Generate a Python Notebook from this scenario.*



2.

3. Name it "*Housebuilding_Generated_Notebook"* and Save it.
4. Return to the Project page by clicking on the navigation shortcut.

5. Click on Assets to view all the project's components. Under the Notebooks section, click on the name of the notebook you just created.
6. WS Local will instantiate the Jupyter Notebook and display its contents.
7. Insert a new Markdown cell at the very top and enter a notebook title. Run the cell to see the result!