Creating Master Problems in Variate

Problems in Variate can be created to allow for automatic randomization of values for each student who completes the problem. Additionally, Variate allows you to create different types of multi-part problems including both multiple choice and numerical or expression free-response.

Prerequisites

1. **Navigate** to Variate in a web browser, either through your existing Brightspace course with a Variate external learning tool link, or by using a direct link to Variate. **Log in** using your Purdue Career Account credentials.

2. Under the “Manage” tab, select “Problems”.

Creating A New Master Problem

1. **Click** the “New Master Problem” button on the upper right-hand side of the Problem Library.

2. **Name** the problem in the space provided.
Creating Variables

1. You can create variables with defined parameters so that they can be randomized for each student who completes the problem. Variables can be used in problem statements, response formulas, multiple choice options, or to calculate other variables. There are a variety of ways to add variables, and for more details you can view the Variate help section (https://purdue.variate.org/help#variables). For our purposes, you can create a variable by selecting “New Variable” on the right-hand side of the screen.

2. Next, name the variable you are creating. Variable names can be letters, words, or symbols.
3. After naming the variable, **define** what values that variable will be permitted to take on when randomized. You can do this by creating a list of values, a range of values, or creating a formula.

**List of Values:** Simply list all possible values of the variable with each value separated by semicolons.

![List of Values](image1)

**Range of Values:** Select the minimum and maximum values of the range of the variable. You may also indicate for the variable to increase by a certain interval (in this example, by increments of 5). And finally, if the variable should not take on certain values within this range, simply exclude those values by creating a semicolon separated list. The number format chosen will change how a variable appears to a student in the problem statement.

![Range of Values](image2)
**Formula:** If the value of the variable you are creating is dependent upon another variable you have created; you can create a formula to establish this relationship. In the hypothetical equation below, the variable “x” needs to always be greater than variable “y” by 2, so you can use the formula “y + 2" to determine the value of “x”.

![Formula Image]

The number format and rounding chosen will change how a variable appears to a student in the problem statement.

**PLEASE NOTE:** All variables that have been created within the master problem will be identified as a green “pill”. Any variables you would like to include in your problem must be selected form the list of green “pills”. Simply typing “y” will not be recognized as the variable. However, you may use double brackets as a shortcut when typing. Typing “{{y}}” will automatically be replaced with the green “y” variable pill.
4. Once you have defined your variables, they will all be visible on the right-hand side of the screen. You will be able to see the variable name as well as how that variable is defined. Additionally, you will see how many potential problem combinations can be generated from your variables. You will also notice that your variables will be shown as green “pillars” under the problem statement section. You will be able to select variables from this list to add them into a problem as will be shown in the next section of this document.

![Image of the problem statement and variables]

Creating the Problem Statement

1. When writing the problem statement, you will have access to many text editing features. This will allow you to format the problem statement as you see fit.

![Image of the problem statement and variables with formatting options]
2. If you need to include a mathematical expression into the problem statement, you can select the formula button (labeled $f_x$) to do this. From this screen, you will be able to select from your list of variables and format the equation appropriately.

![Edit Formula](image)

**NOTE:** If you need to create additional variables while creating the formula, you can do so by clicking the “+ Variable” button. Also, mathematical symbols can be typed in using your keyboard, or, by selecting the virtual keyboard icon on the right-side of the screen. This will also give you access to additional symbols that are not found on your keyboard.

**NOTE:** You can create multiple problem statements on the same problem. This will allow for you to create multi-part questions with multiple answers. To do this, scroll to the bottom of the problem statement screen and select “Add Prompt”.
Creating Response Types

1. Variate will allow you to create 3 different kinds of response types. These options are numeric, expression, and multiple choice.

**Numeric:** Selecting this response type will require that a student provide a numeric response to the problem. You will need to enter a formula that will evaluate to the correct answer. Creating the response formula is done in the same way as creating a formula variable (see above).

You will also be able to select if the answer should be rounded, and if so, to how many decimal places. Additionally, you can select how the number should be formatted. This will change how a value is displayed to a student. That does not mean a student is required to answer in this number format. A student’s answer is graded on whether it is numerically correct.

Additionally, you may create a tolerance range for the correct answer. This is recommended for problems that might be rounded throughout solving. If the student’s answer is within the specified range, it will be counted as correct.
There are also a spaces provided to create an answer prefix and unit that the student will see next to the response box. For example, you might place a “$” as a prefix to indicate that their answer should represent a monetary value or “lbs” to indicate the appropriate units for a response.

**Expression:** Selecting this response type will require a student to enter a simplified mathematical expression rather than a specific numeric answer. Similarly, to the numeric response option, you will need to provide a formula that will be equivalent to the correct answer.

This response option will also allow you to add a prefix to the response box. Additionally, you have two options to set the strictness of the comparison between the correct answer and student answer. For more information, you may view the Variate help section about expression equivalence. ([https://purdue.variate.org/help#response-expression-equivalence](https://purdue.variate.org/help#response-expression-equivalence))

**Multiple Choice:** Selecting this response type will require the student to choose the correct answer from multiple options. Create a response that you would like to label as correct. Then, create as many incorrect options as you would like. Both the correct and incorrect answers can take the form of formulas, pictures, or text. Once you have created all your answer choices, be sure to select which answer is the correct one. When students are taking the problem, answer choices will be presented in random order.
NOTE: On all response types, you are permitted to make a multi-part question with multiple answers. To add an additional answer, click “Add Response” at the bottom of the “Response Type” section.

Previewing and Saving Master Problems

1. While creating a master problem, save your work and progress regularly. This can be done at any point by selecting the blue “Save” button at the bottom of the screen.

   Also, at any point, you may select “Save & Preview”. This will save all your work and show you a preview of what your master problem will look like from the perspective of the student.

2. While previewing a problem, you will see the problem statement and response box in the form in which they will be presented to the student. Underneath the problem, you will see what the correct answer is (use this to verify the accuracy of your formulas) and the permitted tolerance for the students’ answers.
To further test your problem, you can select the blue “Randomize” button in the lower right-hand corner and a new problem will be generated for you to evaluate.

3. You may tag your problem with certain keywords that will make it easier to identify and search for in your problem library. Be sure to separate each tag with a comma or by using the “Enter” key on your keyboard.

4. If you would like to allow other people to access this master problem in Variate, you can do so by selecting “Edit Owners” in the upper right-hand side of the screen. After the window opens, enter
the Purdue career account or PUID of the individual you would like to share the problem with. **NOTE:** This will allow the individual to make changes to the problem.

5. Once you have saved a problem, it will be accessible in your “Problem Library”. If the problem is marked with a green checkmark, solutions can be calculated and the problem is available for use in assessments.