If-then-else branching and logical tools

ArcGIS Pro 3.4

In this topic

If-then-else logic is a concept for performing actions based on different conditions. If-then-else logic can be explained as follows: if the condition is true, then perform an action, else perform a different action.

In ModelBuilder, if-then-else logic can be added using the set of built-in logical tools or with custom Python functions or script tools.

Logical tools

Logical tools control the flow of processes in a model and enable if-then-else branching logic.

Logical tools	Description
If Coordinate System Is	Evaluates the input data for the specified coordinate system.
If Data Exists	Evaluates whether the specified data exists.
If Data Type Is	Evaluates whether the input data matches the specified data type.
If Expression Is	Evaluates whether a given Python expression is True or False.
If Feature Type Is	Evaluates whether a feature class is of the specified feature type.
If Field Exists	Evaluates if the input data has the specified fields.
If Field Value Is	Evaluates if the values in an attribute field match a specified value, expression, or second field.
If Row Count Is	Evaluates the row count of the input data and checks whether it matches a specified value.
If Selection Exists	Checks whether the input data includes a selection and whether a certain number of records are selected.
If Spatial Relationship Is	Evaluates whether the inputs have a specified spatial relationship.
If Value Is	Evaluates an input value compared to a single value, a list of values, or a range of values using a defined comparison operator.
Merge Branch	Merges two or more logical branches into a single output.
Stop	Exits a model out of the iteration loop if the input values are set to true or set to false. For the set of input values, iteration will continue if all the inputs are true and stop if any one of the inputs is false. It is functionally similar to the While tool but is useful to stop a model if there is one While iterator in a model and no additional iterators can be added.

Learn more about using the logical tools in ModelBuilder

Python

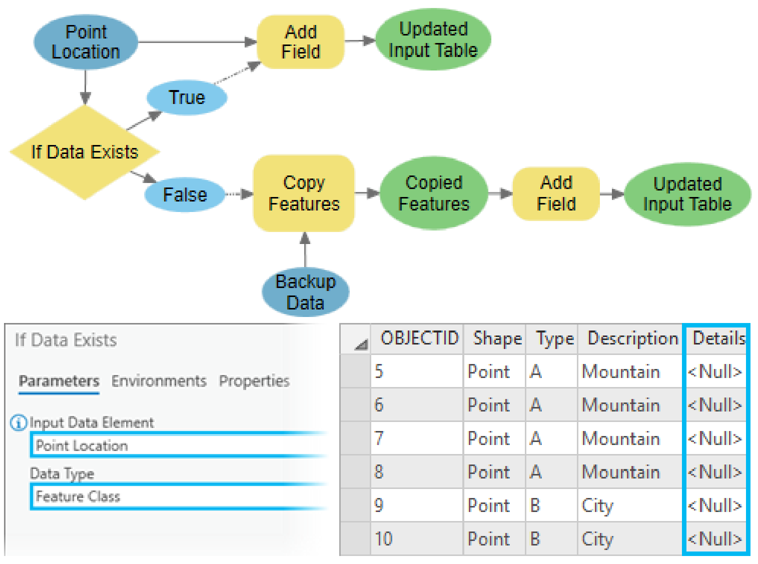
In addition to the built-in logical tools in ModelBuilder, you can write your own functions and tools to perform if-then-else branching using custom Python functions with the Calculate Value tool. These functions can test conditions using a variety of arcpy and other Python capabilities, and output Boolean true and false variables. Similarly, you can write a Python script that tests conditions and outputs Boolean true and false variables, make the script a geoprocessing script tool, and add the script tool to your model.

Understanding conditions

Before choosing from the system tools or writing custom scripts, it is good practice to understand the conditional logic based on vector or raster data types.

Run a model only if a file exists

The following example uses the If Data Exists tool to check for the existence of data in a particular workspace, and if data does exist, continue running the next tool, Add Field, in the model. If it does not exist, copy the feature class from a backup location before adding a field.



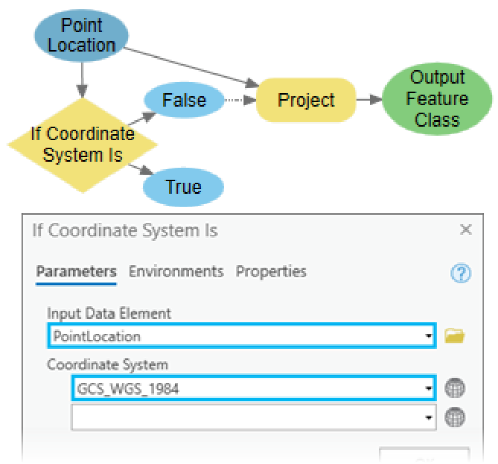
Input Data Element: Point Location

Data Type: Feature Class

OBJECTID	Shape	Type	Description	Details
5	Point	A	Mountain	<Null>
6	Point	A	Mountain	<Null>
7	Point	A	Mountain	<Null>
8	Point	A	Mountain	<Null>
9	Point	B	City	<Null>
10	Point	B	City	<Null>

Run a model only if an input has a specific coordinate system

The following example uses the If Coordinate System Is tool to check whether the Coordinate System value of the input feature class is GCS_WGS_1984. If the Boolean output is False, the model will use the Project tool to project the input feature class to GCS_WGS_1984.

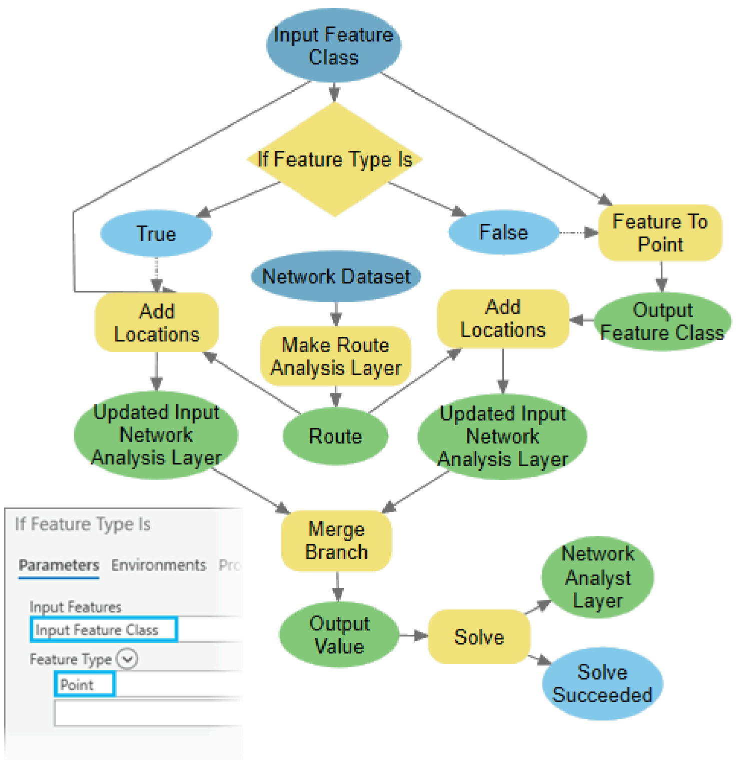


Input Data Element: PointLocation

Coordinate System: GCS_WGS_1984

Run a model only if an input feature class is a particular geometry type

The following example uses the If Feature Type Is tool to check whether the input's feature type is Point. If the Boolean output is True, run the next tool, Add Locations. If the Boolean output is False, convert the input Feature To Point tool before running the Add Location tool. The Merge Branch tool merges the True and False branches so that the Solve tool can be run on either branch.

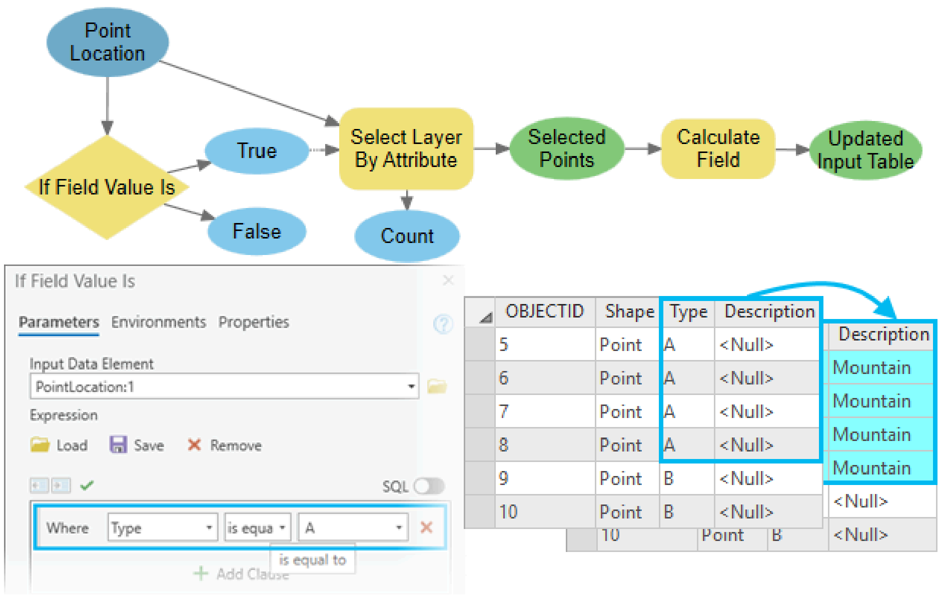


Input Features: Input Feature Class

Feature Type: Point

Modify field values based on a condition

The following example uses the If Field Value Is tool to check whether the input feature class has any records with the Type field value equal to A. If the Boolean output is True, select type A features using the Select Layer By Attribute tool, and modify the Description field values using the Calculate Field tool.



If Field Value Is

Parameters Environments Properties

Input Data Element: PointLocation:1

Expression

Load Save Remove

SQL

Where Type is equal to A

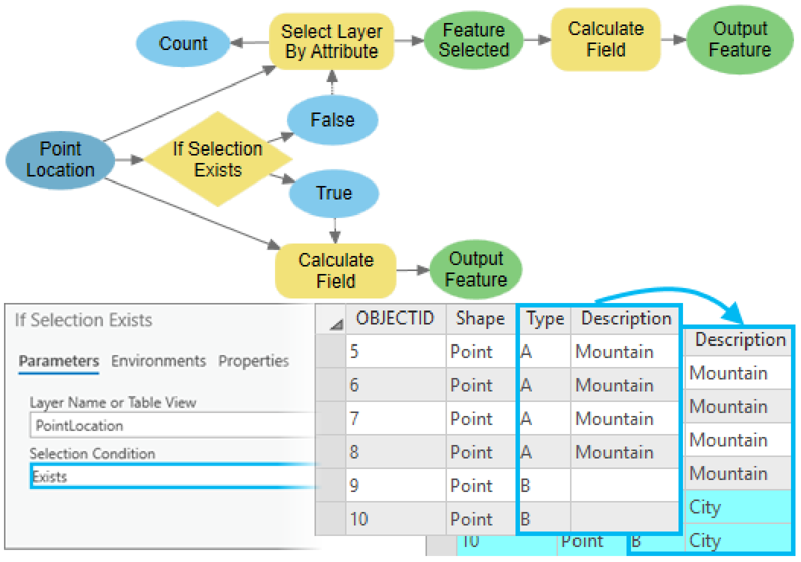
Add Clause

OBJECTID	Shape	Type	Description
5	Point	A	<Null>
6	Point	A	<Null>
7	Point	A	<Null>
8	Point	A	<Null>
9	Point	B	<Null>
10	Point	B	<Null>

Description
Mountain
Mountain
Mountain
Mountain
<Null>
<Null>

Run a model only if an SQL query results in any selected features

The following example uses the If Selection Exists tool to check whether the input feature class has any selected features. If the Boolean output is True, use the Calculate Field tool to calculate values of the Description field. If the Boolean output is False, use the Select Layer By Attribute tool to make the selection and modify field values.



If Selection Exists

Parameters Environments Properties

Layer Name or Table View: PointLocation

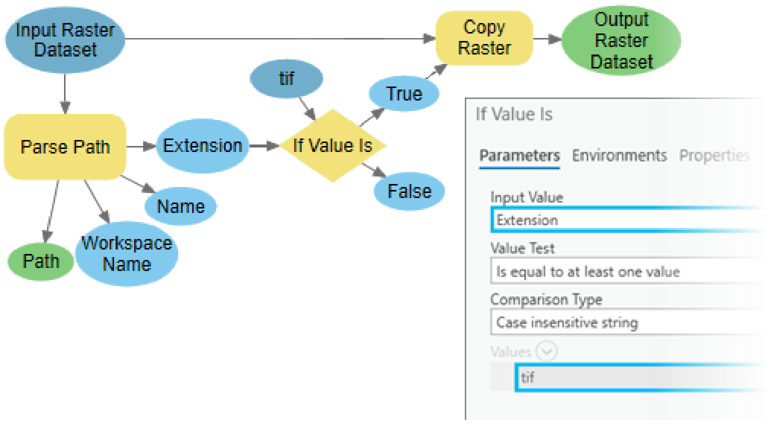
Selection Condition: Exists

OBJECTID	Shape	Type	Description
5	Point	A	Mountain
6	Point	A	Mountain
7	Point	A	Mountain
8	Point	A	Mountain
9	Point	B	
10	Point	B	

Description
Mountain
Mountain
Mountain
Mountain
City
City

Run a model only if an input is a specific data type

The following example uses the Parse Path tool to get the file extension. The If Value Is tool checks whether the extension matches the Values parameter. The model only copies raster data with a .tif extension.



If Value Is

Parameters Environments Properties

Input Value: Extension

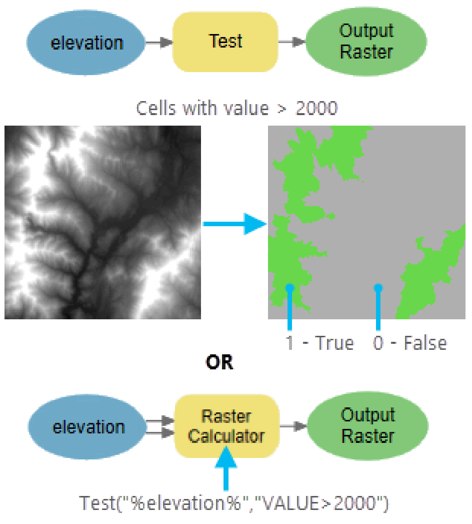
Value Test: Is equal to at least one value

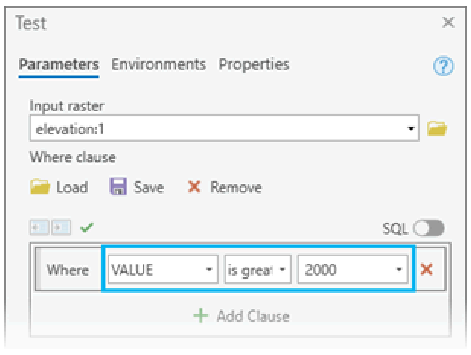
Comparison Type: Case insensitive string

Values: tif

Perform a Boolean evaluation of a raster

The Test, Con, Greater Than, and Raster Calculator tools can be used to perform a Boolean evaluation of raster. In the following example, if a cell value is greater than 2000, then set to 1 (True), else set to 0 (False).



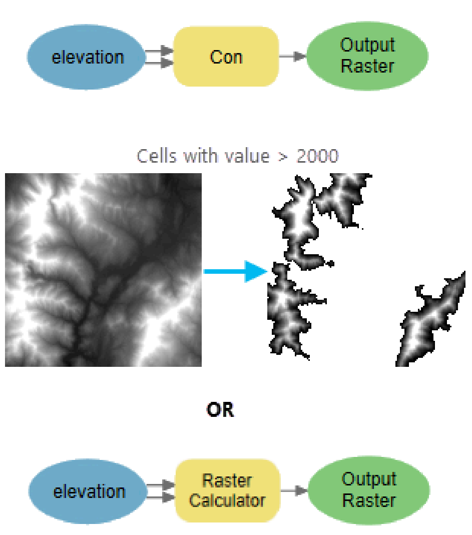


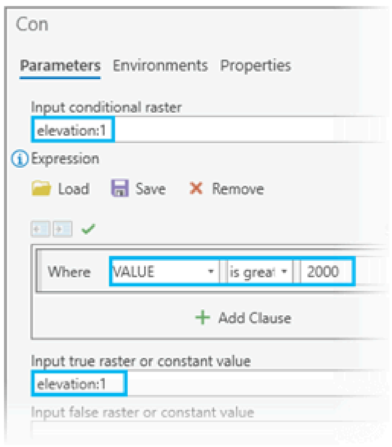
Input raster: elevation:1

Where clause: Where VALUE is great 2000

Perform a conditional evaluation of a raster

The Con or Raster Calculator tool can be used to conditionally evaluate a raster. In the following example, if a cell value is greater than 2000, then keep the input value, else set to NoData. Leaving the Con tool Input false raster or constant value parameter empty sets the value to NoData. Optionally, you can provide another raster or a constant value for the Input false raster or constant value parameter.



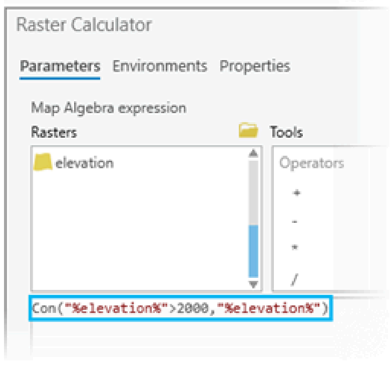


Input conditional raster: elevation:1

Expression: Where VALUE is great 2000

Input true raster or constant value: elevation:1

Input false raster or constant value

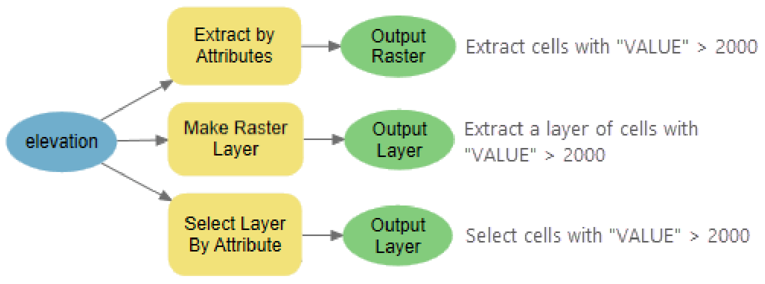


Map Algebra expression

```
Con("%elevation%">2000,"%elevation%")
```

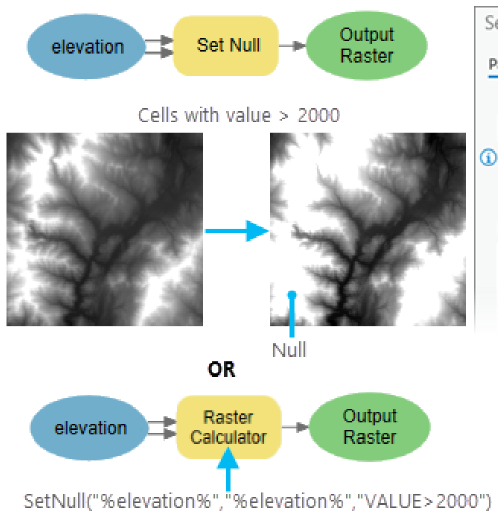
Extract cells from a raster with a query

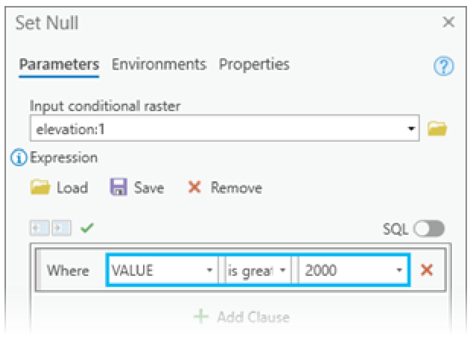
The Extract By Attribute, Make Raster Layer, and Select Layer By Attribute tools can be used to extract cells from a raster. The following example shows methods to create a raster or a raster layer with cell values greater than 2000.


Extract by Attributes
Output Raster
Extract cells with "VALUE" > 2000
elevation
Make Raster Layer
Output Layer
Extract a layer of cells with "VALUE" > 2000
Select Layer By Attribute
Output Layer
Select cells with "VALUE" > 2000

Extract cells from a raster with a query and set them to NoData

The Set Null, Reclassify, and Raster Calculator tools can be used to extract cells from a raster and set them to NoData. If the cell value is greater than 2000, then set to NoData, else use the input data value.



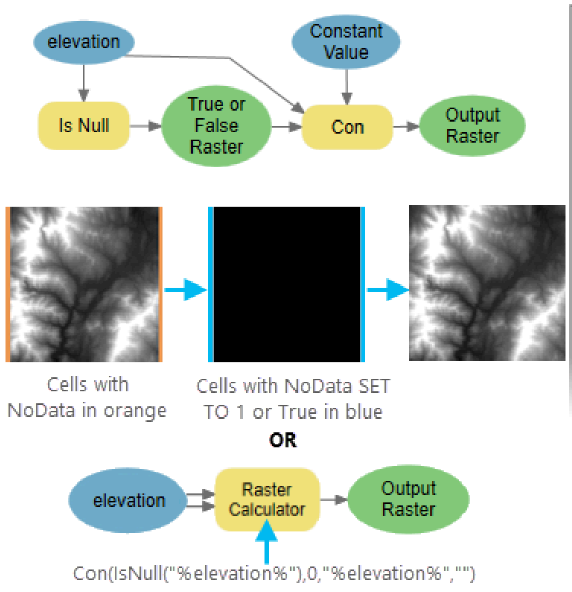


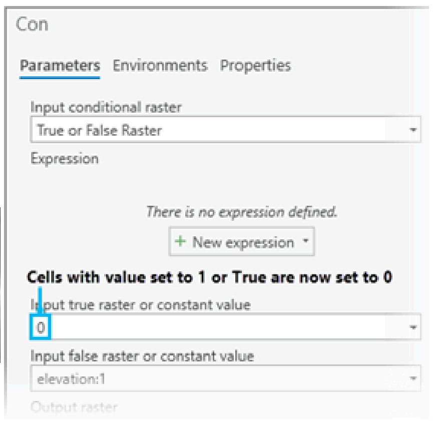
Input conditional raster: elevation:1

Expression: Where VALUE is great 2000

Extract NoData cells from a raster with a query and modify them

The Is Null tool with the Con tool, or the Raster Calculator tool can be used to extract NoData cells from a raster and modify them. In the following example, if a cell value is NoData, then set to 0, else use the input data value.


elevation
Constant Value
Is Null
True or False Raster
Con
Output Raster
Cells with NoData in orange
Cells with NoData SET TO 1 or True in blue
OR
elevation
Raster Calculator
Output Raster
Con(IsNull("%elevation%"),0,"%elevation%","")


Con
Parameters Environments Properties
New expression
Cells with value set to 1 or True are now set to 0
Output raster

Input conditional raster: True or False Raster

Expression: There is no expression defined.

Input true raster or constant value: 0

Input false raster or constant value: elevation:1

Run a model only if a raster property matches a specific condition

For example, to check whether the mean value of all cells is greater than 100, you can use the Get Raster Properties and If Value Is tools.

Continue or stop a tool from running in a model based on a condition

The While and Stop tools can be used to continue or stop a model based on a condition.