Introduction to Simulink

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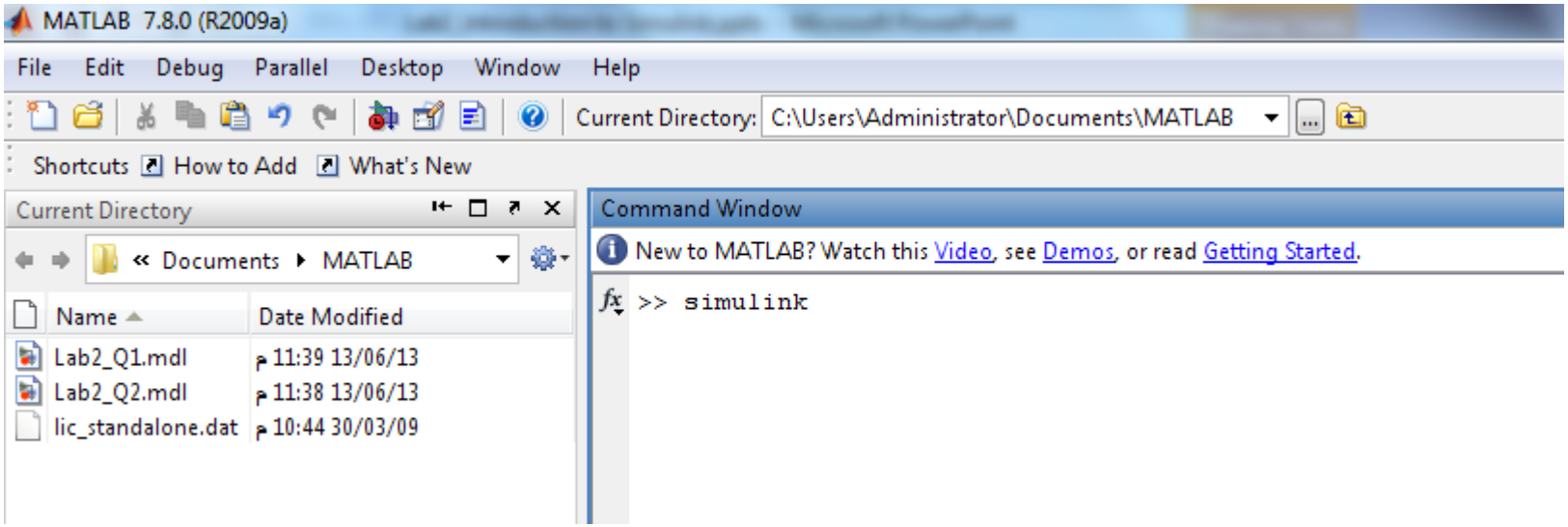
Objectives

- Introduction to Simulink (MATLAB)
- Designing Digital Circuits using Simulink

Starting Matlab

- From Start -> Matlab
- In the command line, type: simulink -> Press Enter and wait for a moment (it may take few seconds)



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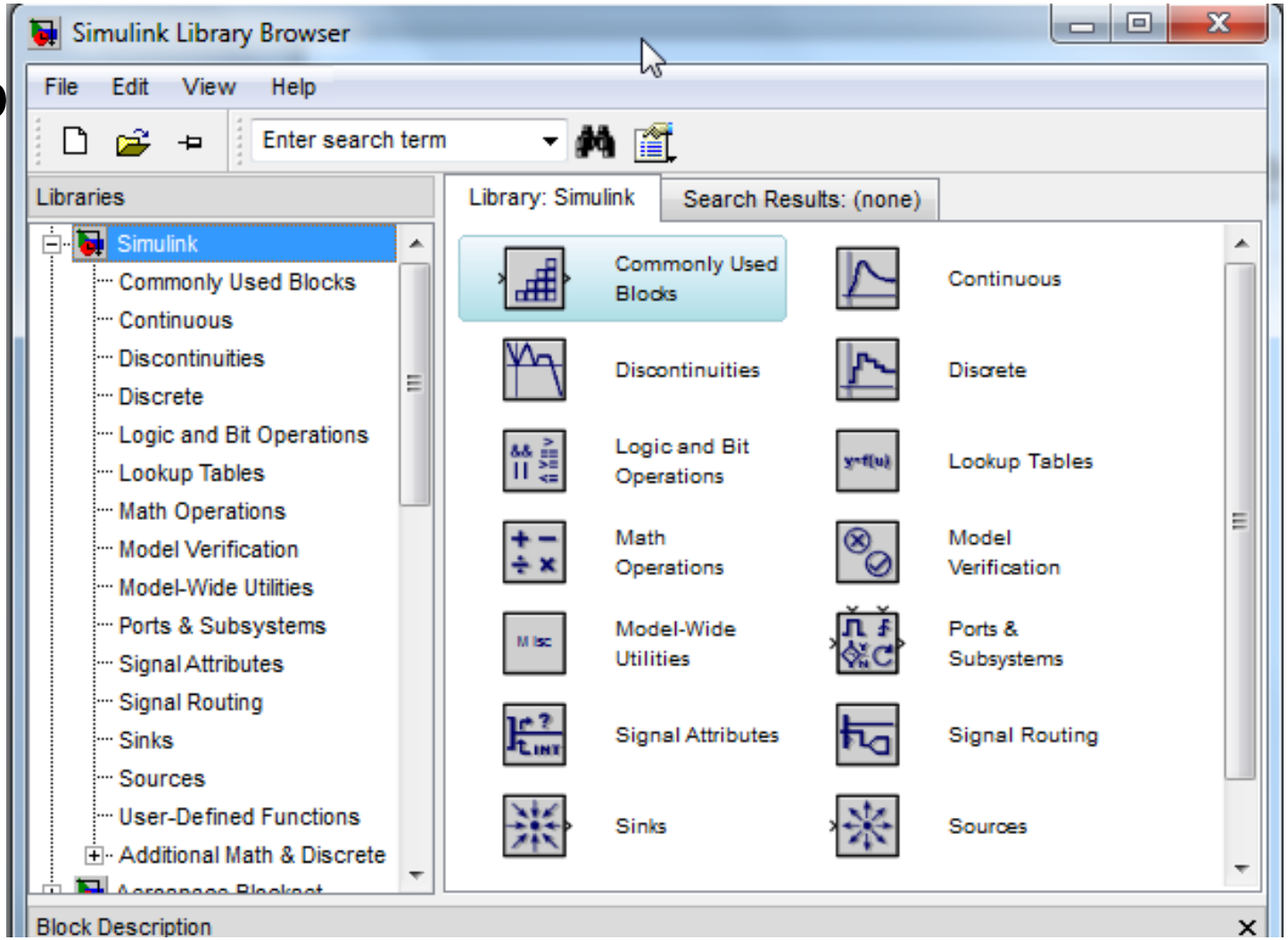
Simulink Library Browser
File
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View
Help
Enter search term
Libraries
Simulink
Commonly Used Blocks
Continuous
Discontinuities
Discrete
Logic and Bit Operations
Lookup Tables
Math Operations
Model Verification
Model-Wide Utilities
Ports & Subsystems
Signal Attributes
Signal Routing
Sinks
Sources
User-Defined Functions
Additional Math & Discrete
Library: Simulink
Search Results: (none)
Commonly Used Blocks
Continuous
Discontinuities
Discrete
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Lookup Tables
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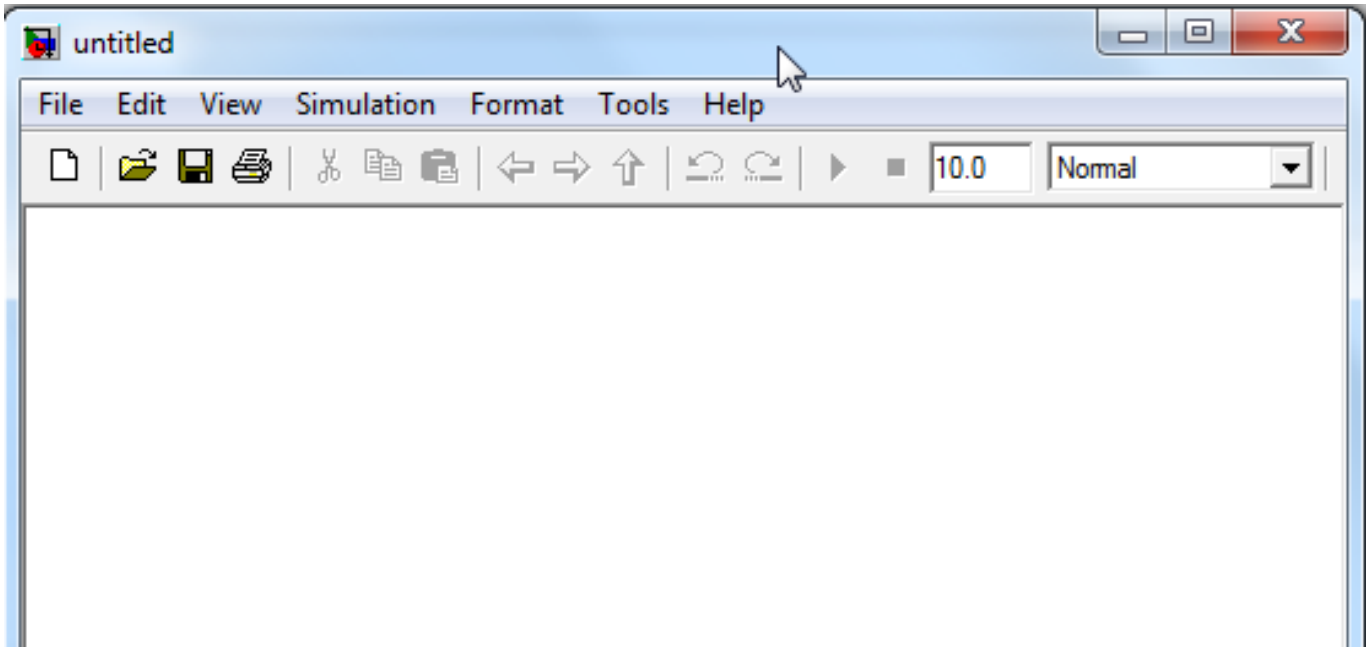
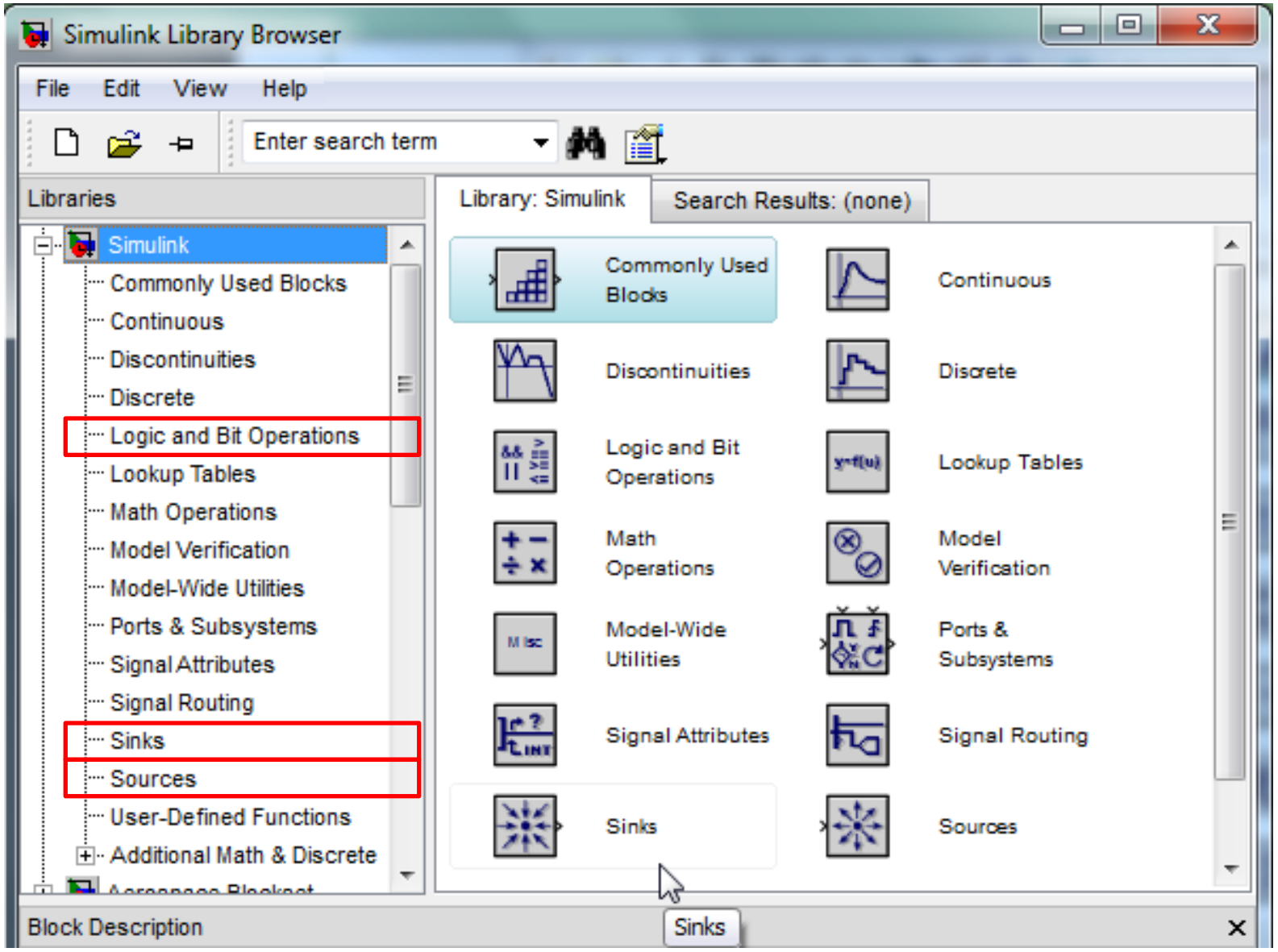
Model Verification
Model-Wide Utilities
Ports & Subsystems
Signal Attributes
Signal Routing
Sinks
Sources
Block Description

- From File -> New -> Model
- You will get a blank window like this:



- To draw a circuit, we have 3 main categories for the components:
  - Input -> *Source*
  - Gate -> *Logical and Bit Operation*
  - Output -> *Sink*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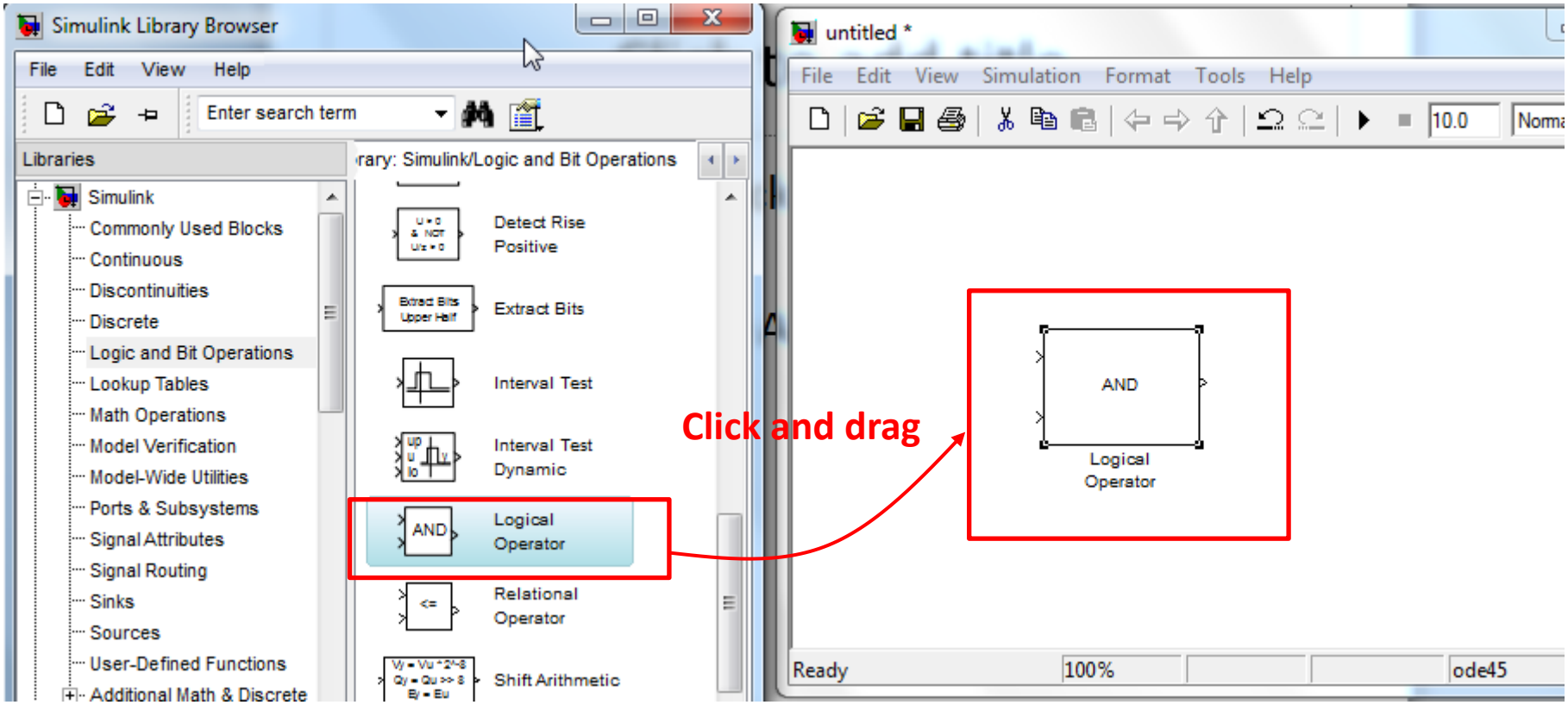
Block Description
Sinks

- To draw a gate, click on Logic and Bit Operations.
- Click and drag the AND logical operator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User-Defined Functions
Additional Math & Discrete
Detect Rise Positive
Extract Bits
Interval Test
Interval Test Dynamic
AND
Logical Operator
Relational Operator
Shift Arithmetic
Click and drag
untitled *
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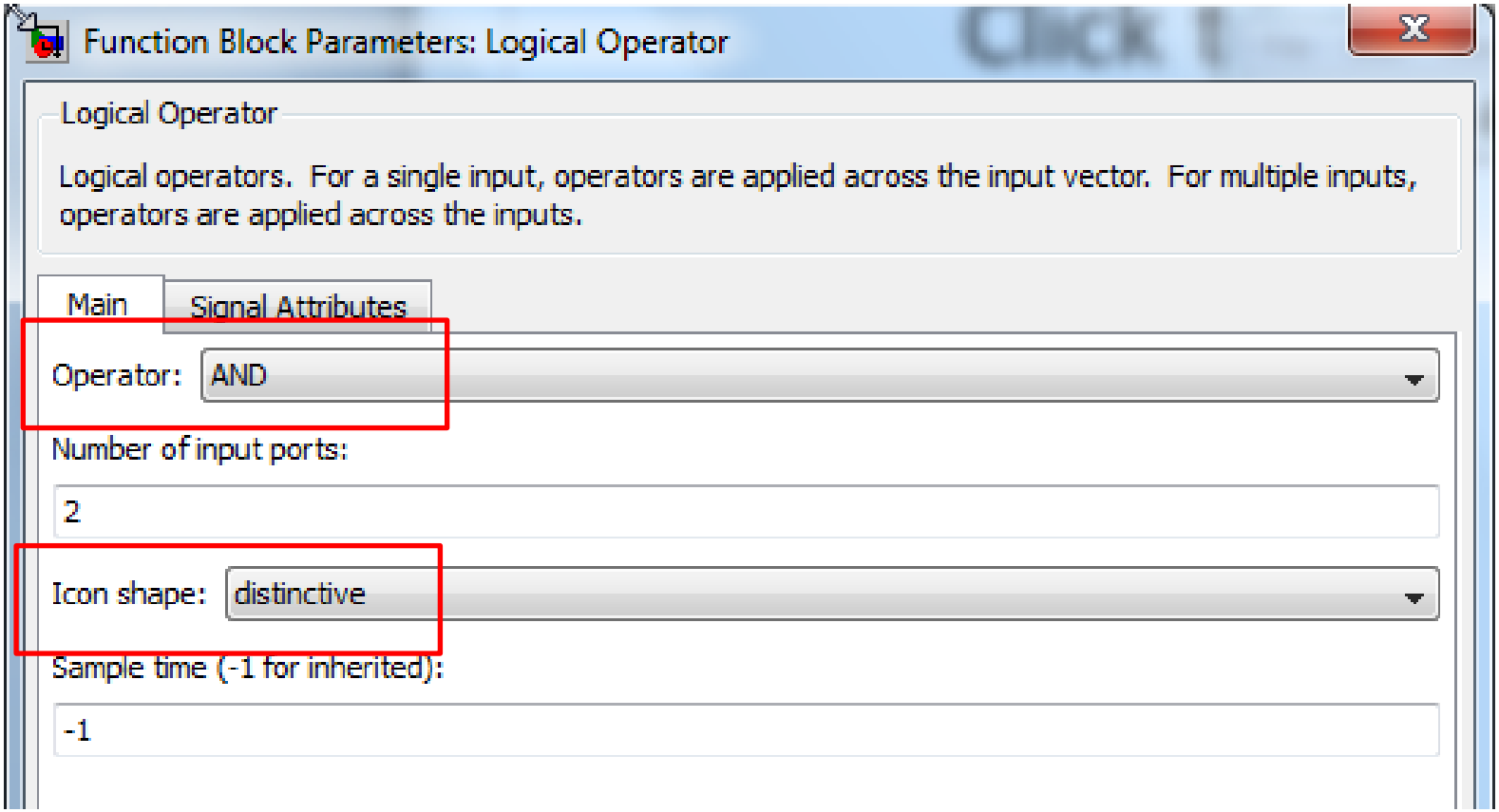
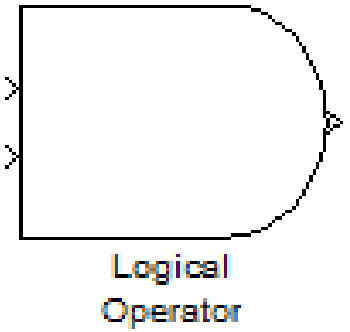
10.0
AND
Logical Operator
Ready
100%
ode45

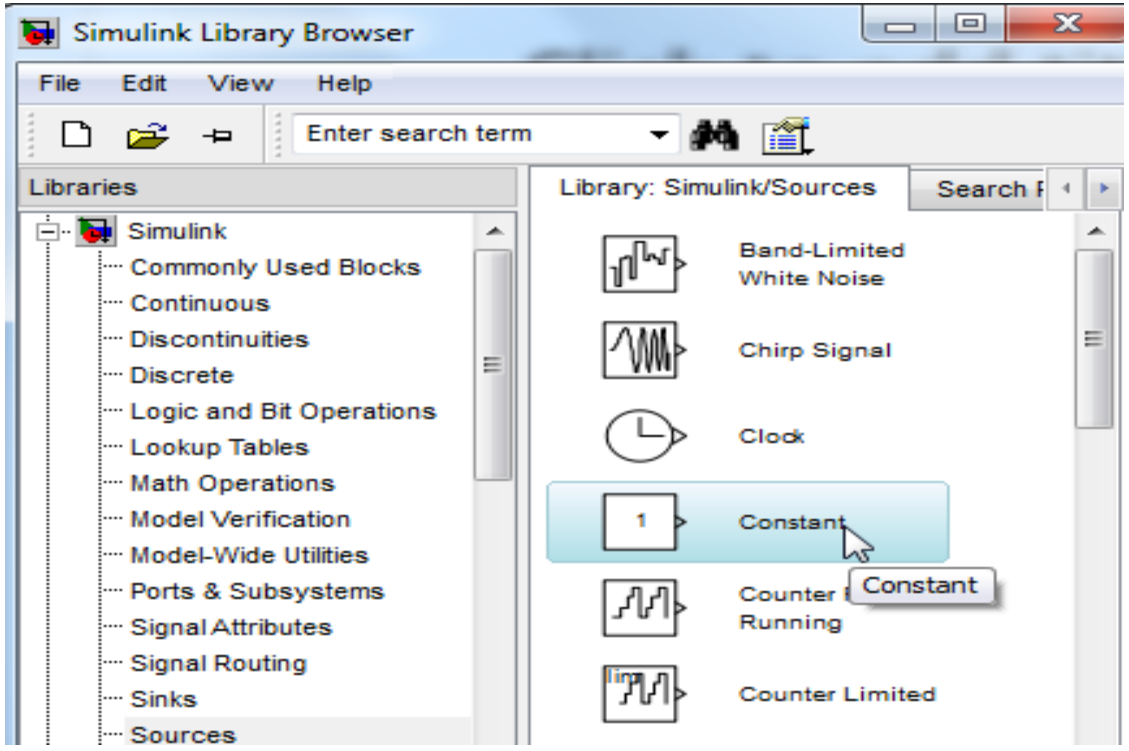
- To change its shape and type (to OR, NAND, etc.) double-click on the gate
- Operator: AND / OR / NOR
- Icon shape: select distinctive to make the known shape for the gate operator


Function Block Parameters: Logical Operator
Logical Operator
Logical operators. For a single input, operators are applied across the input vector. For multiple inputs, operators are applied across the inputs.
Main
Signal Attributes
Operator:
AND
Number of input ports:
2
Icon shape:
distinctive
Sample time (-1 for inherited):
-1

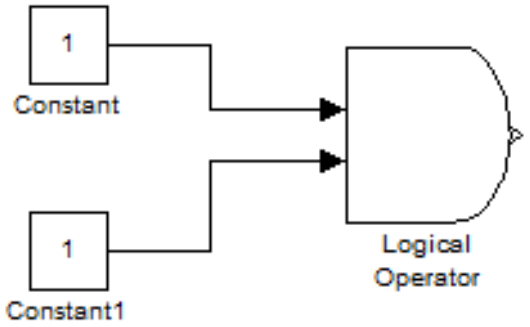
- After changing the logical operator to AND, and the shape to distinctive, the AND gate looks like:



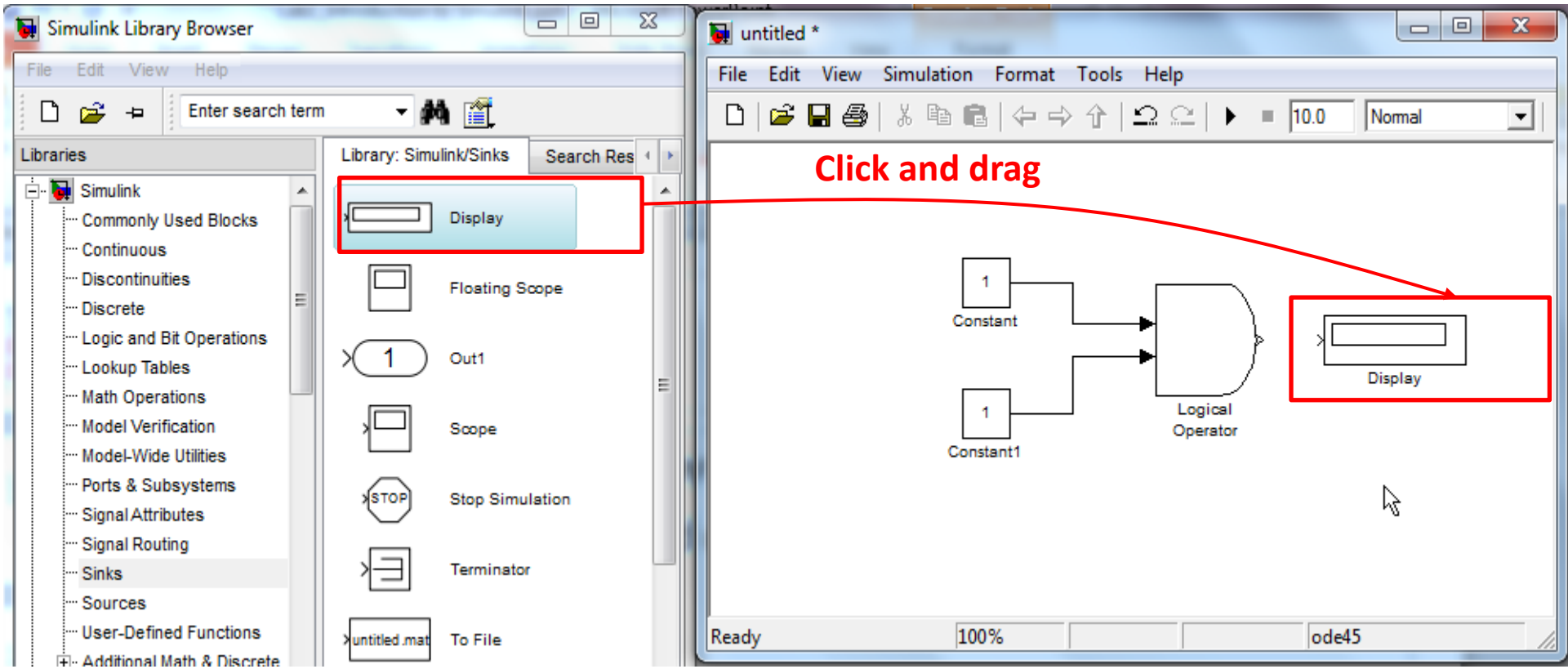
- To add a constant input, from Source -> Constant
- Drag and drop the constant rectangle



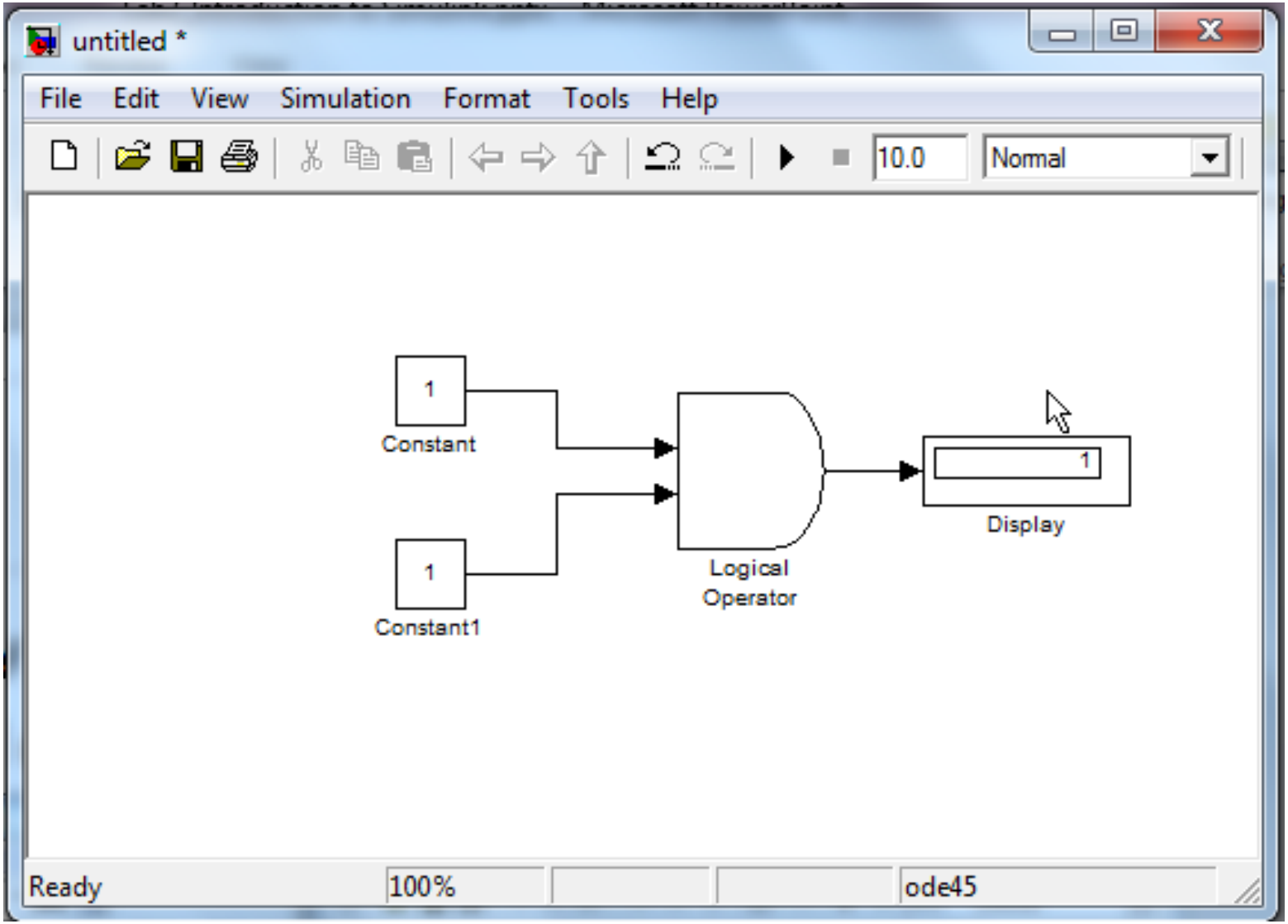
- To change the constant value, double-click on the constant rectangle
- Draw a line by clicking on the constant -> click on the constant + shift -> click on the AND gate



- To display the output, click on the Sinks
- Drag and drop a Display



- Draw a line from the AND gate to the Display rectangle
- Run your Model by click on the *Start Simulation* button 
- You will see the result in the Display rectangle
- Try to change the constants values and watch the Display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Constant
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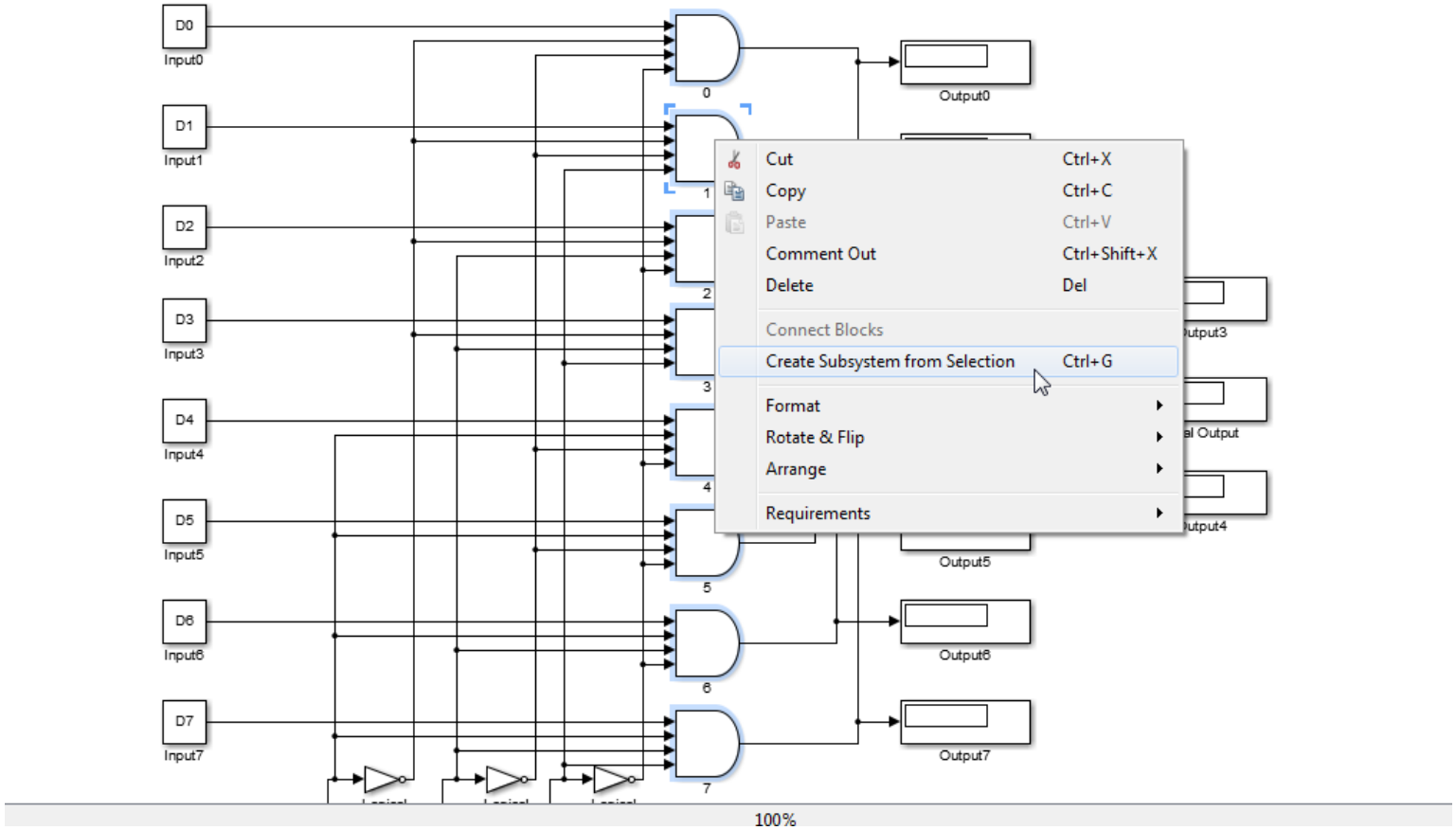
Constant1
Logical
Operator
1
Display
Ready
100%
ode45

To Create a Subsystem

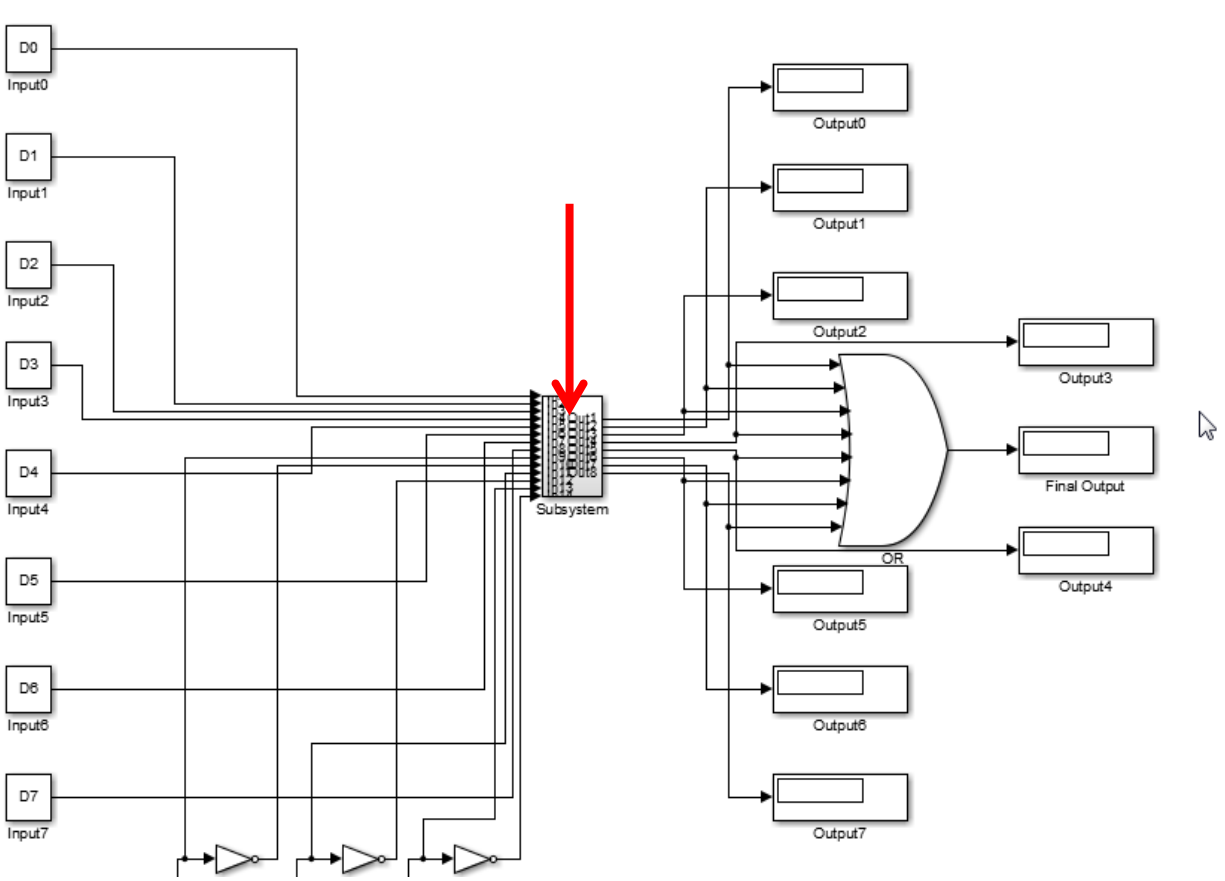
- You need to create subsystems if you have complicated circuit. It allows you to hide the small details inside a subsystem
- Select the details you want to hide -> Right click -> choose “Create subsystem from selection”

Subsystem Example

- I selected all the AND gates in this Multiplexer



- The subsystem hides all the AND gates in one component



Lab Exercise

- Draw the following two functions
  - AB + AC
  - A (B+C)
- Build the two expressions truth table
- Try to use the same constants value in the two circuits. ***What do you observe ?***

HW#1

- Install Matlab Simulink in your own machine
- The SW is available in Student copy. You can buy it online from:

  https://www.mathworks.com/store/link/products/student/?s_tid=ac_buy_sv_cta
- Cost USD $ 89
- Practice drawing circuits

References

- King Abdulaziz University, faculty of computing & IT, CPIS – 210 lab manual Computer Architecture & Organization, pages (8 &9) by Abdul Rauf Malik