Text Mode v. Graphic Editor

STEP BY STEP PROJECT CREATION THROUGH BOTH VHDL AND SCHEMATICS

CANDACE ROSS

EECE494 COMPUTER BUS AND SOC INTERFACING

ELECTRICAL AND COMPUTER ENGINEERING

HOWARD UNIVERSITY

INSTRUCTOR: DR. CHARLES KIM

Pull out your laptops and follow along!

Outline

I. What is text mode versus graphic editor?
II. Text Mode Step by Step
III. Schematic Step by Step
IV. Implementation of VHDL and Schematic on Board
    I. Pin planner
V. Debugging Tips

What is the Difference?

- Text mode:
  - Written code to implement design
  - Better choice for more complex projects
- Graphic mode:
  - Designing circuits to implement design
  - Better choice for simpler projects
  - Also good when its easy to visualize are a logic circuit

Background on the Example We'll Follow

- Create a project called PushLeds
  - 5 inputs: 4 switches, 1 push button
  - 4 outputs: LEDs
- Each switch turns on to light a corresponding LED. Whenever the user holds the push button, the LEDs that should be on will light.

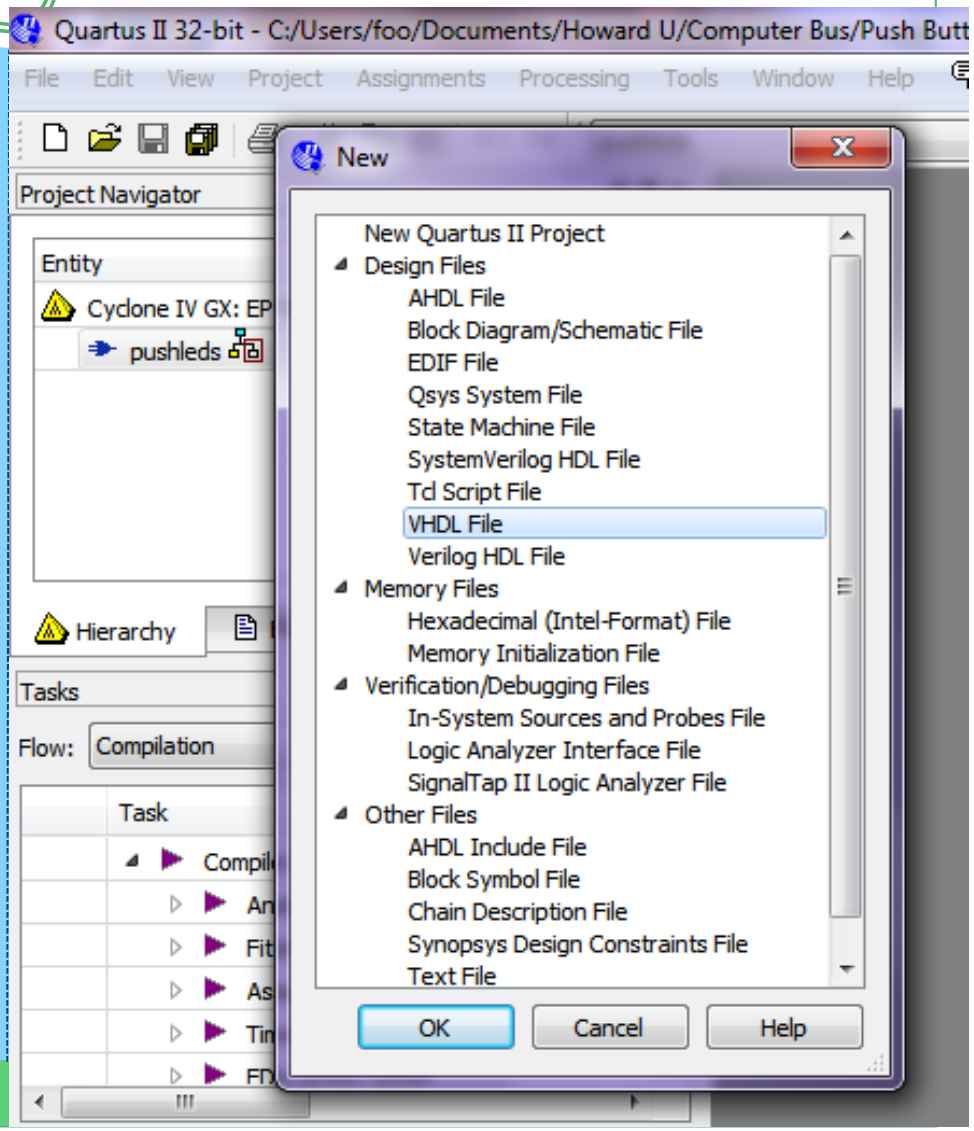
VHDL File

- There are three parts to a VHDL file
  1) Library
  2) Entity
  3) Architecture

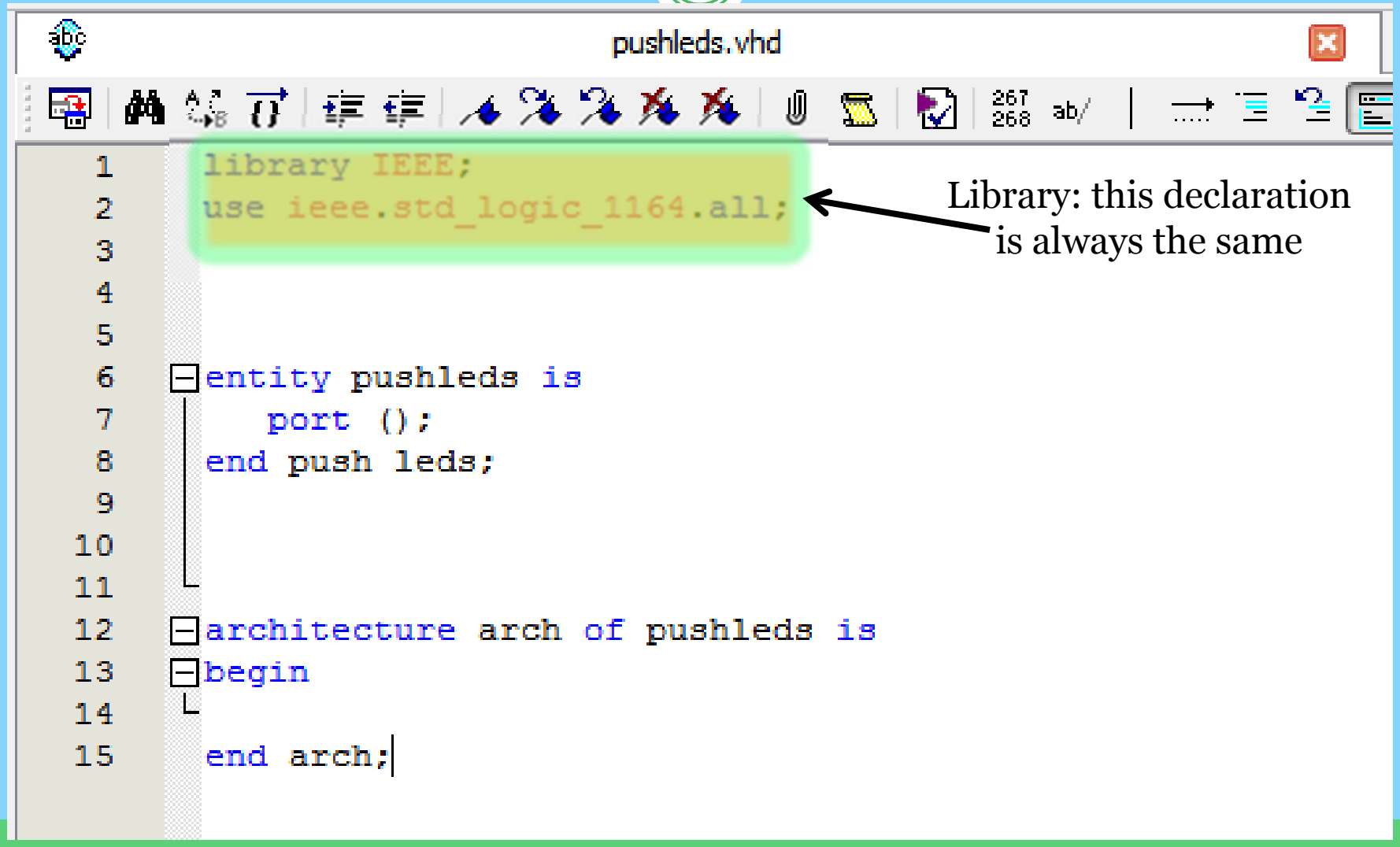
- Let's first go through a blank file and then the example mentioned earlier

Text Mode (VHDL) Steps

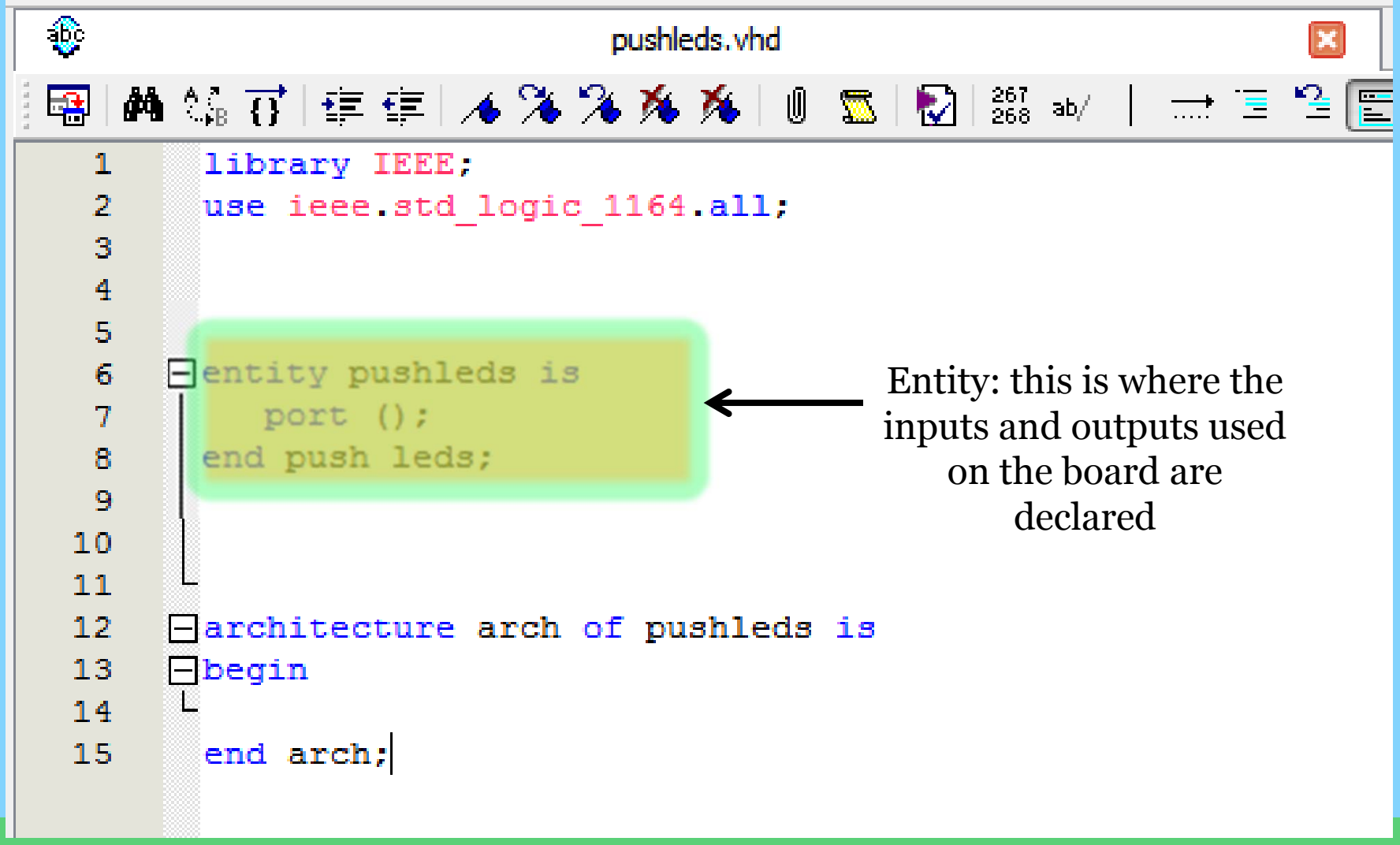
- Create a new VHDL file
- Go to:
  - New > File > VHDL File



Blank VHDL File Example



Blank VHDL File Example



Blank VHDL File Example

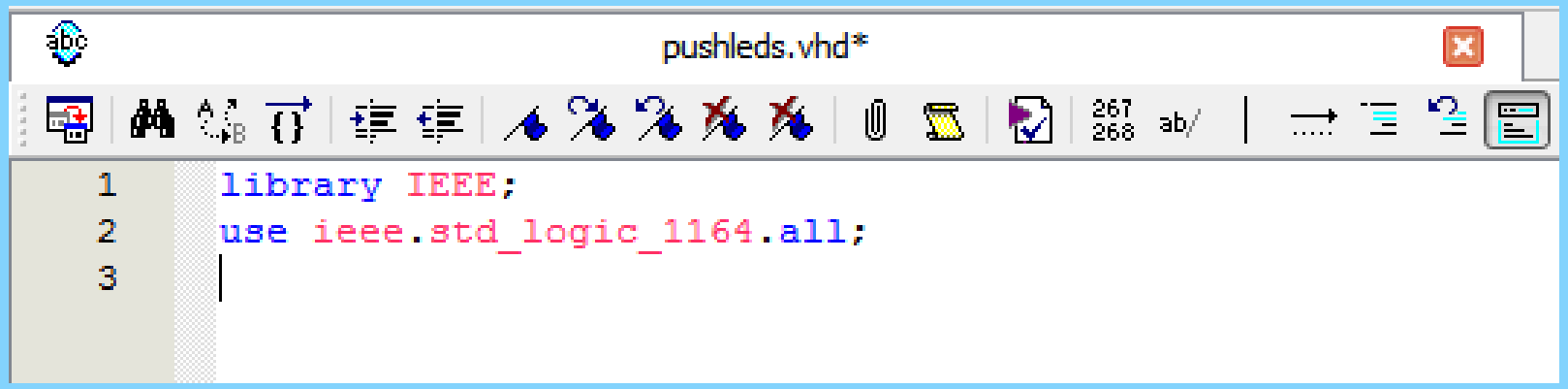
pushleds.vhd

```
1   library IEEE;
2   use ieee.std_logic_1164.all;
3
4
5
6   entity pushleds is
7       port ();
8   end push leds;
9
10
11
12  architecture arch of pushleds is
13  begin
14
15  end arch;
```

Architecture: this is where the actual coding begins!

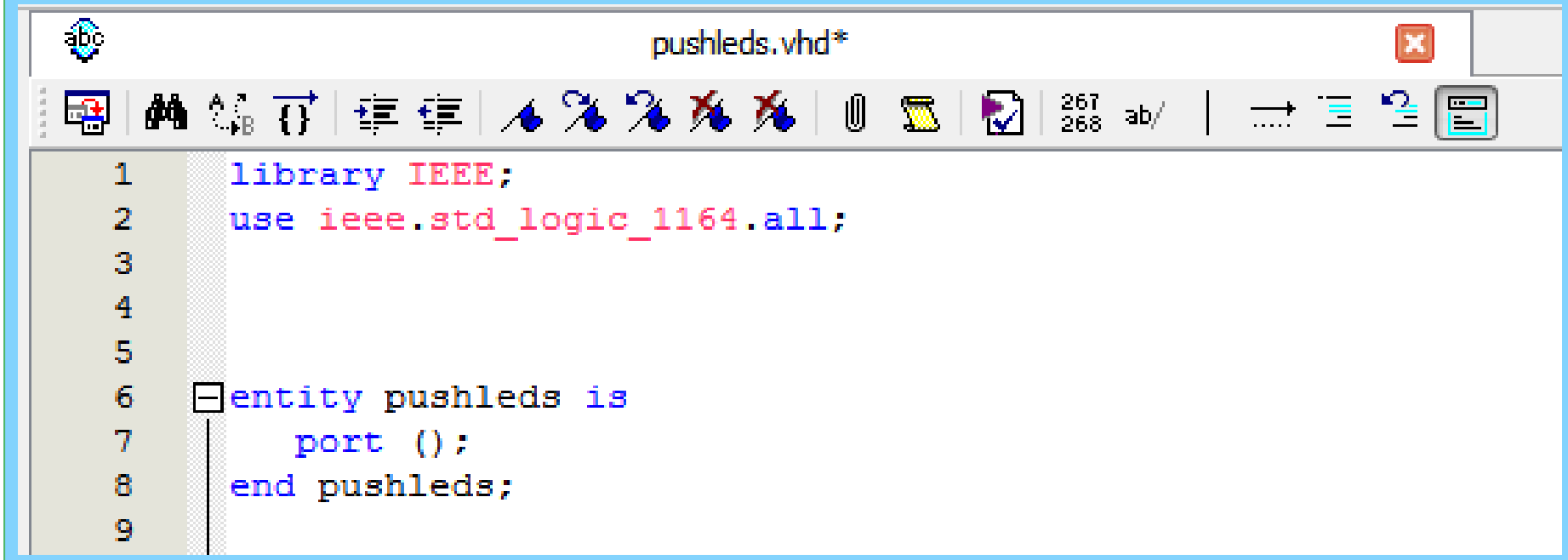
Our VHDL File: Step by Step

- Let's begin with the library declaration



Our VHDL File: Step by Step

- Now move on to the entity
  - The entity name must match the VHDL file name



Our VHDL File: Step by Step

- In the entity, we need to declare our inputs and outputs
- They are:
  - 4 switches
  - 1 push button
  - 4 LEDs

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pushleds.vhd

```
1   library IEEE;
2   use ieee.std_logic_1164.all;
3
4
5
6   entity pushleds is
7      port (switch1 : in std_logic;
8            switch2 : in std_logic;
9            switch3 : in std_logic;
10           switch4 : in std_logic;
11           pushbuton: in std_logic;
12           LED1 : out std_logic;
13           LED2 : out std_logic;
14           LED3 : out std_logic;
15           LED4 : out std_logic);
16  end pushleds;
```

Our VHDL File: Step by Step

- Architecture: We will actually apply what we want our board to do using code
- First, observe the format of the empty architecture

```
16  end pushleds;
17
18
19  architecture arch of pushleds is
20  begin
21
22  end architecture;
```

Our VHDL File: Step by Step

- Our goal is for each LED to turn on when its switch is on; let's begin there…

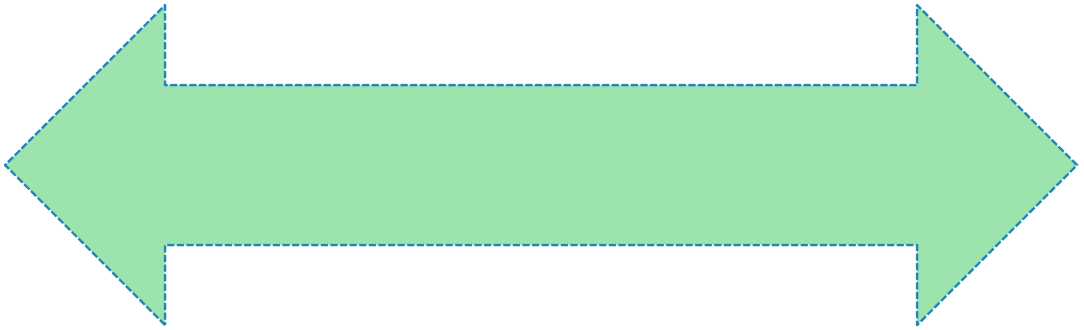
```
18
19  architecture arch of pushleds is
20  begin
21      LED1 <= switch1;
22      LED2 <= switch2;
23      LED3 <= switch3;
24      LED4 <= switch4;
25  end architecture;
```

Our VHDL: Step by Step

- We also only want the LEDs to light when the push button is pressed

```
18
19  architecture arch of pushleds is
20  begin
21      LED1 <= switch1 AND pushbutton;
22      LED2 <= switch2 AND pushbutton;
23      LED3 <= switch3 AND pushbutton;
24      LED4 <= switch4 AND pushbutton;
25  end architecture;
```

ANY QUESTIONS ON VHDL CODE?

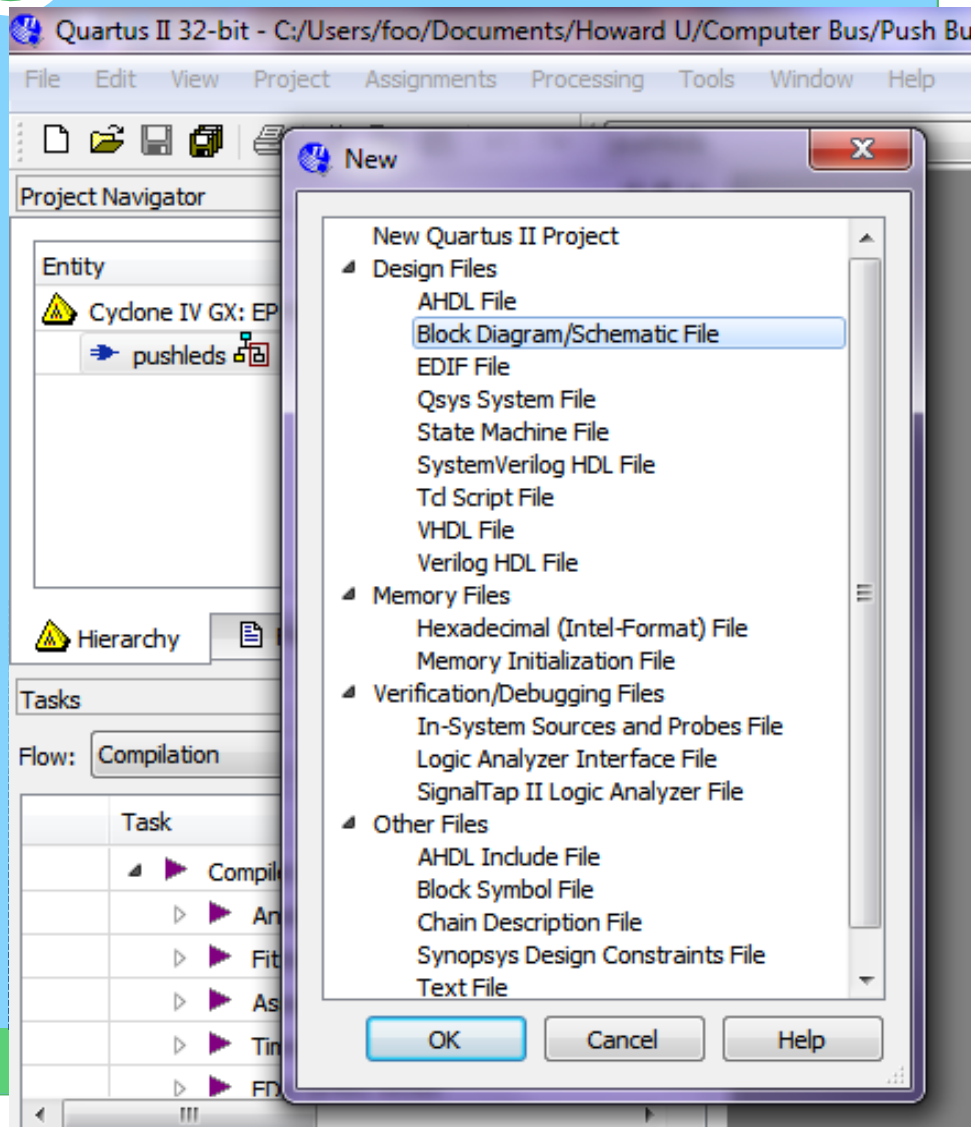


Graphic Mode: Step by Step

- Instead of creating a VHD file, create a schematic

- Go to:

  File > New >Block Diagram/ Schematic File

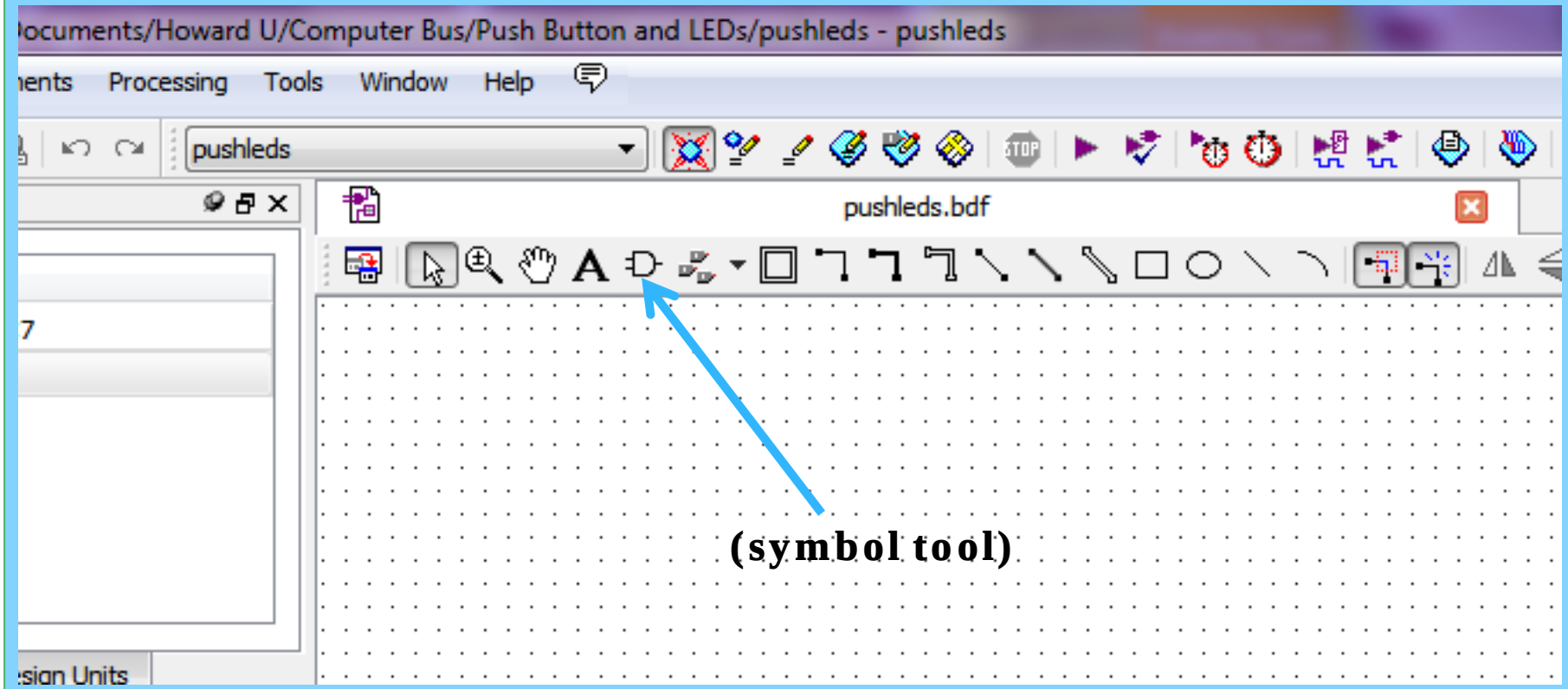


Graphic Mode: Step by Step

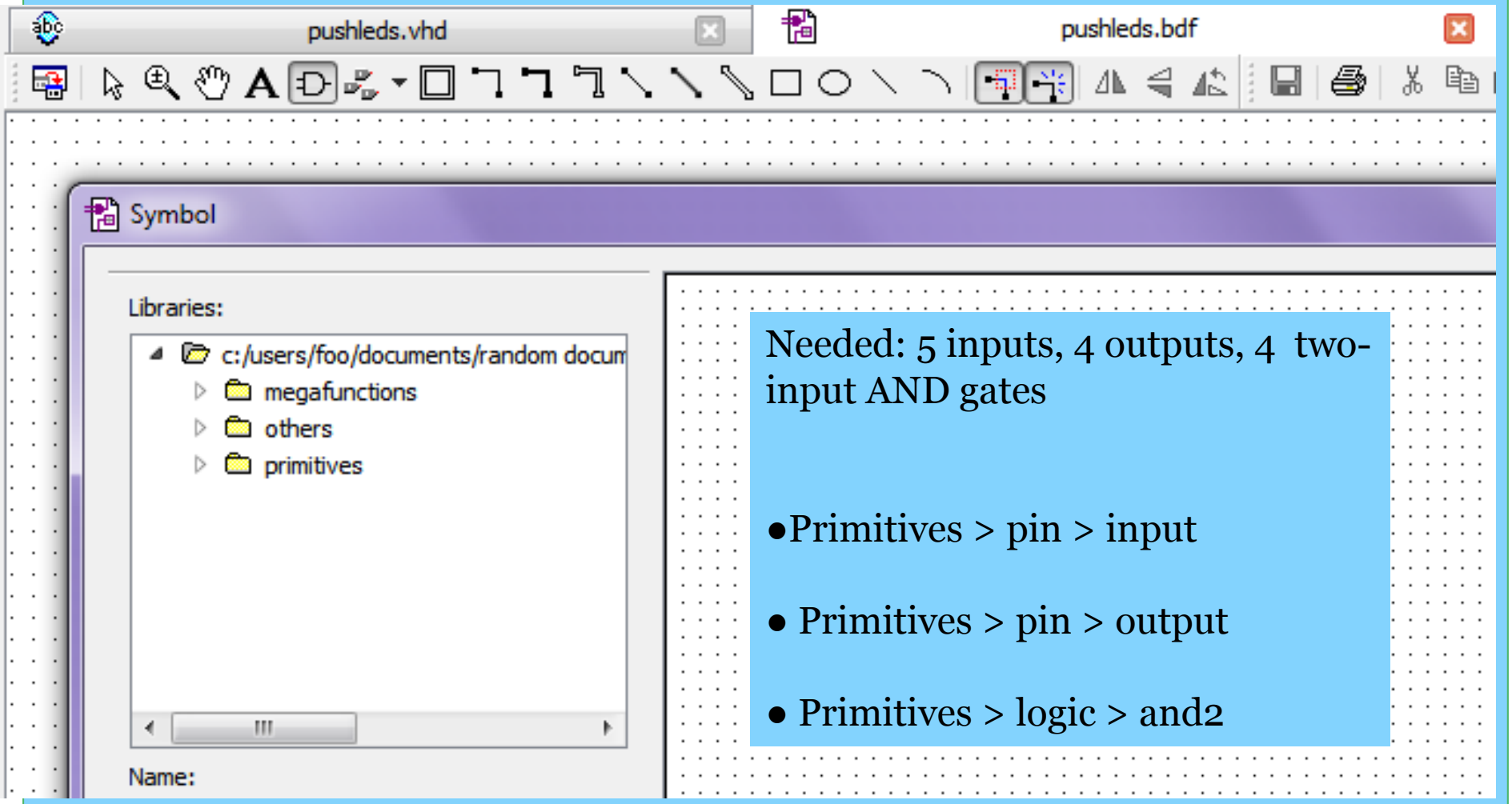
- Similarly to the VHDL file, we will create the project using a circuit
- There are still 5 inputs and 4 outputs
- Use digital logic to create the circuit

Graphic Mode: Step by Step

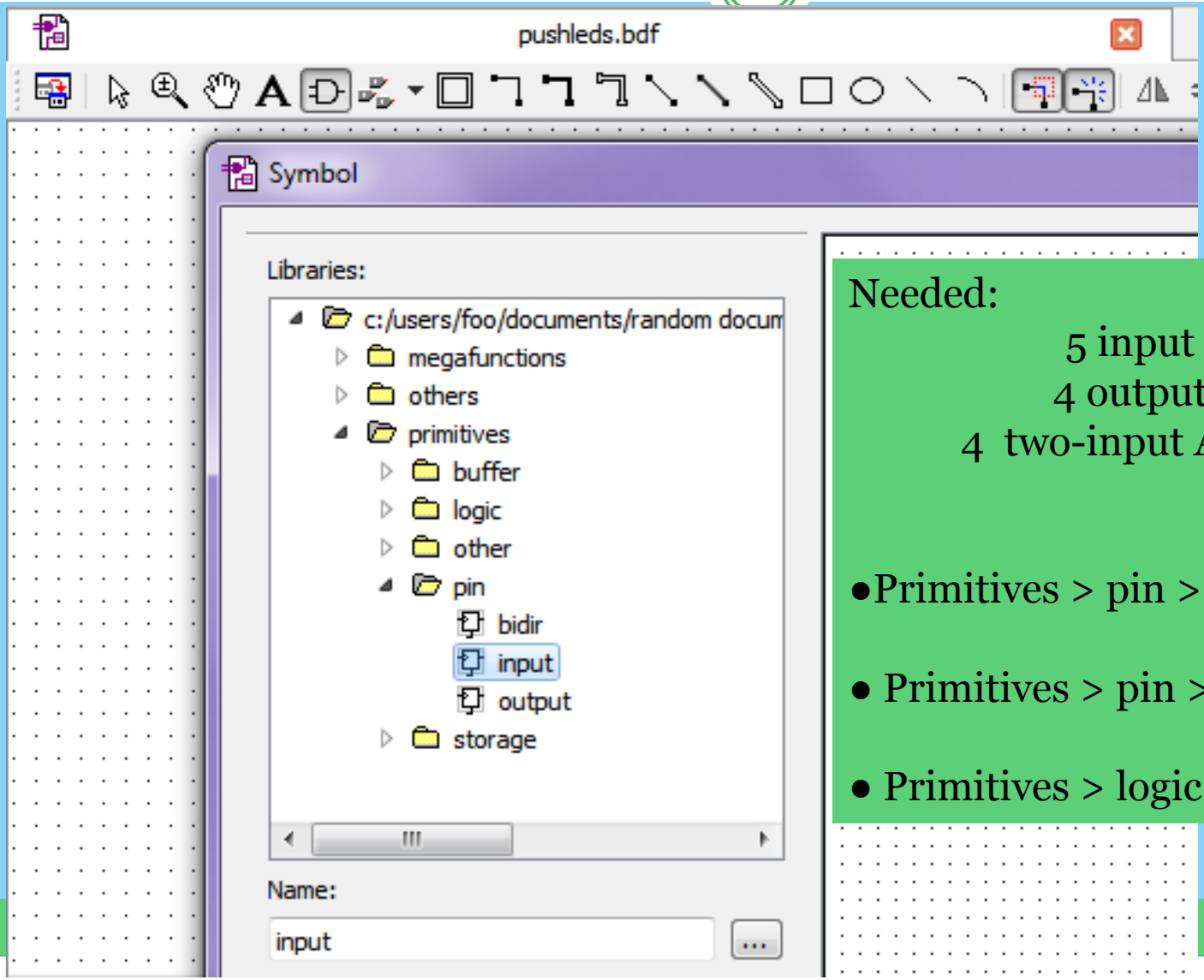
- To include any inputs, outputs or logic gates, go here:



Graphic Mode: Step by Step



Graphic Mode: Step by Step



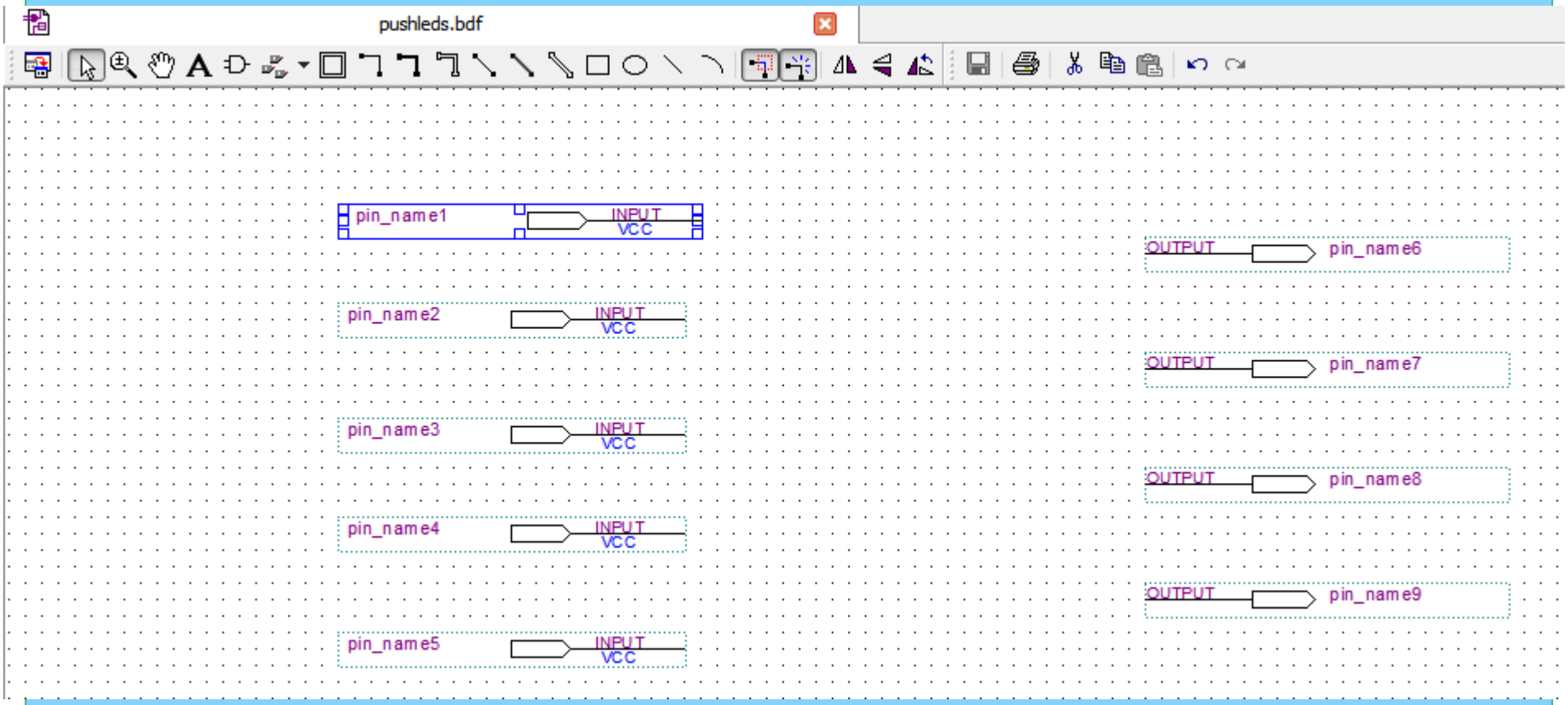
Needed:

5 input pins
4 output pins
4 two-input AND gates

- Primitives > pin > input
- Primitives > pin > output
- Primitives > logic > and2

Graphic Mode: Step by Step

- Let's begin by inserting our 5 inputs and 4 outputs

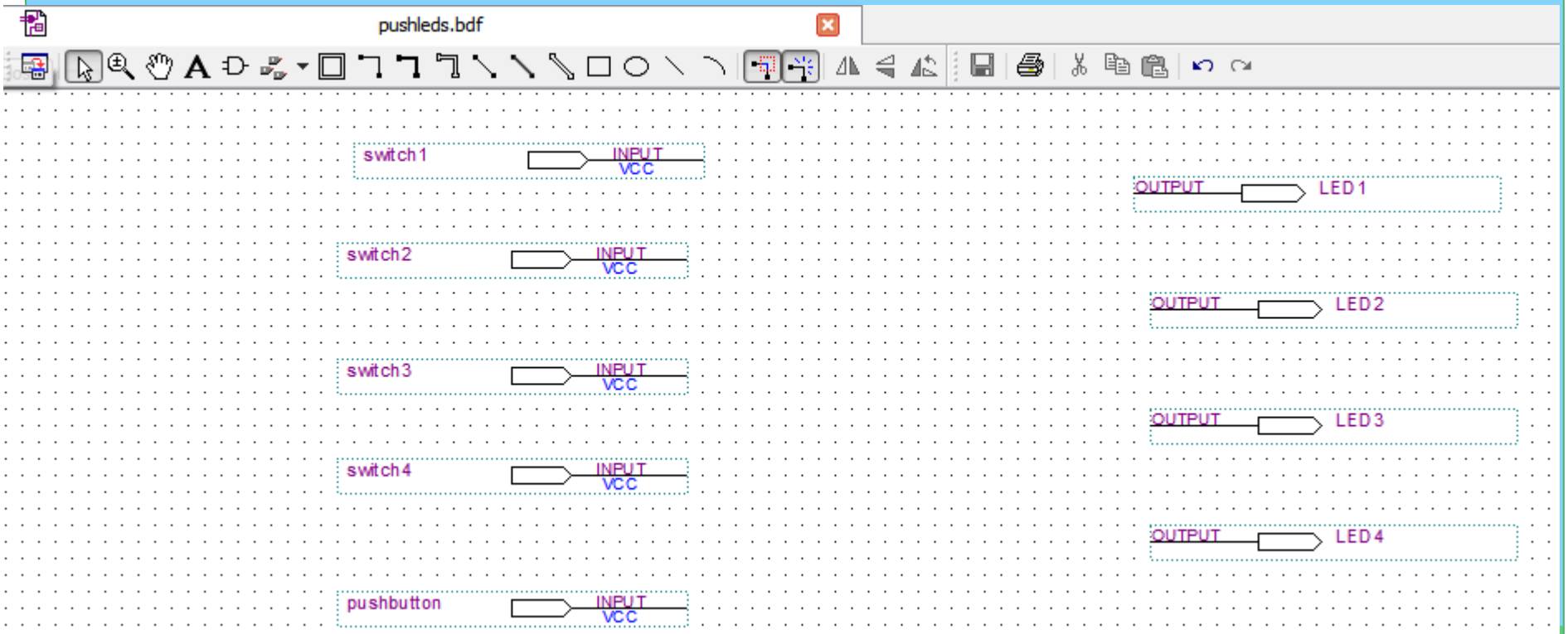


Graphic Mode: Step by Step

- … and let's name our pins
  - Just double click on the input or output
  - Switch1, switch2, led1, led2…

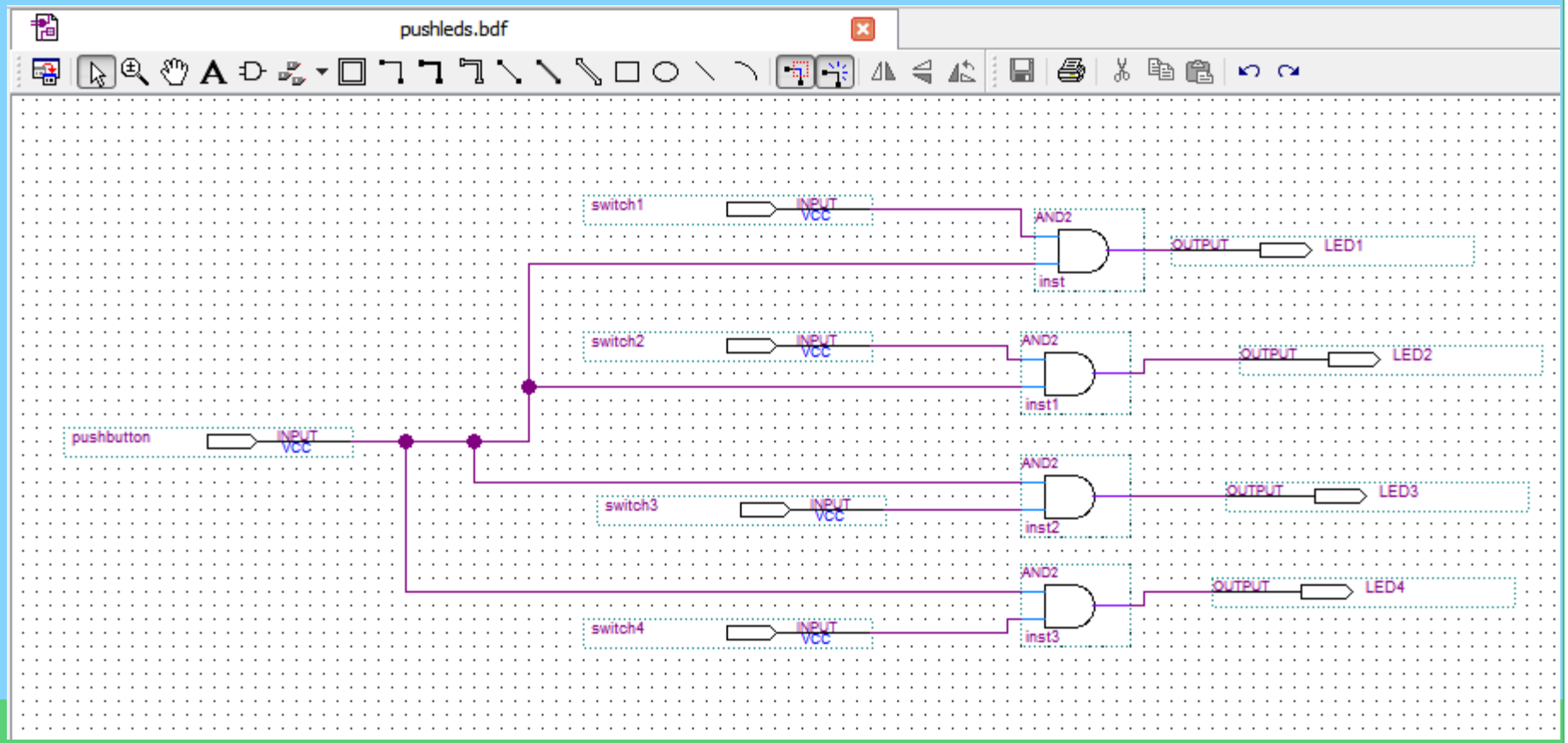
Graphic Mode: Step by Step

- … and let's name our pins
  - Just double click on the input or output



Graphic Mode: Step by Step

- We can finish by inserting our AND gates
  - Ex: LED1 <= switch1 AND pushbutton



ANY QUESTIONS ON THE SCHEMATICS?

Implementation: the Finishing Touch

- For the sake of time, we will not actually implement in class
- The following slide give details on the on-board implementation
- There are also additional example problems that can be practiced, using both the schematics and VHDL

Helpful Debugging Tips