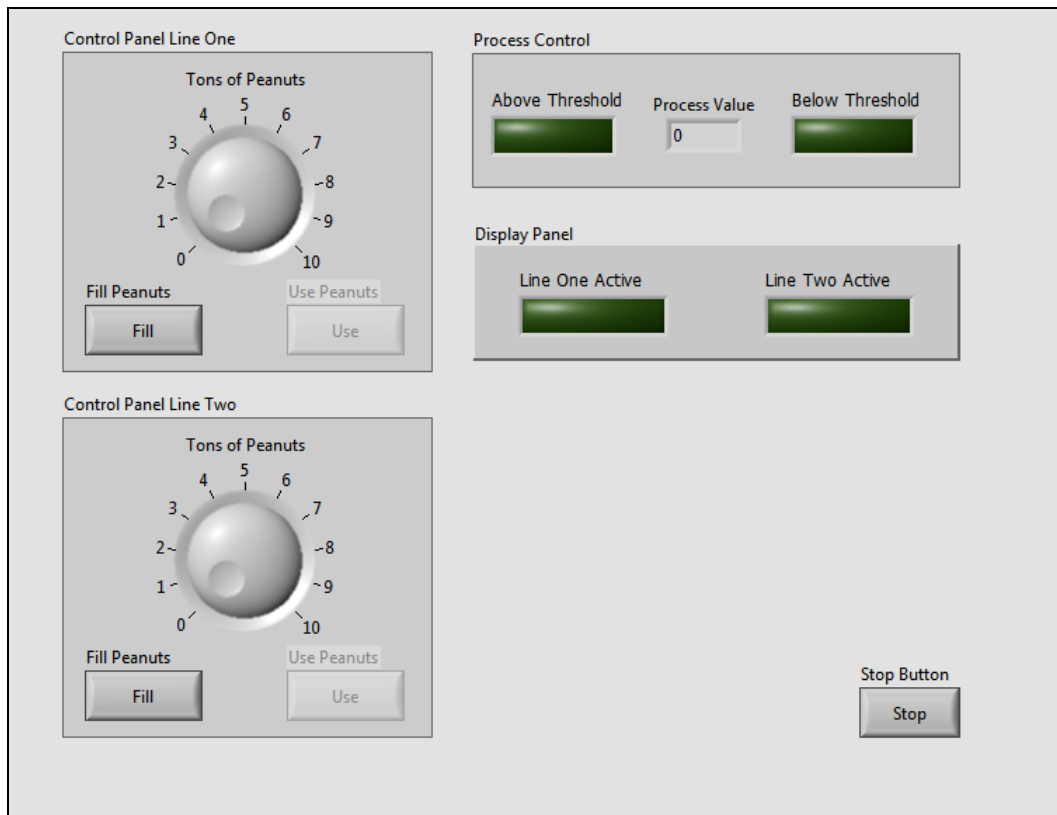


## CLD Exercise 16: State Machine with Enables and Disables

### Objective

Develop a state machine that simulates peanut processing using the given application front panel (Figure 1).



**Figure 1.** Application Front Panel

### General Operation

The application loosely simulates two peanut hoppers at a processing plant. The application has specific UI requirements to disable and enable controls based on the **Tons of Peanuts** knob values. The weight (tons) of peanuts in the hopper can be directly increased or decreased, simulating removal or addition of peanuts. Additionally, the **Fill** button increases the number on the dial, and the **Use** button decreases the number on the dial. When the **Use Peanuts** button is clicked, simulating the processing of peanuts, a process value is generated to simulate the quality of the peanuts, and compared to an upper and lower threshold value.

## **Application Terminology**

### **Tons of Peanuts**

This is the current weight of peanuts. This indicator can be changed directly, simulating the filling or emptying of peanuts in the hopper. In addition, this value can be increased or decreased using the **Fill** or **Use** buttons, representing specific plant processes.

- **Fill peanuts**

This action increases the **Tons of Peanuts** by one. This must be inactive when the amount is full (or 10). This control is disabled when the **Tons of Peanuts** is 10.

- **Use peanuts**

Reduces the **Tons of Peanuts** by one. This initiates peanut processing and generates a process value between 0 and 1 and compares the value to thresholds. This control is disabled when the **Tons of Peanuts** is empty (0).

### **Line One and Line Two Active indicators**

These indicators turn ON whenever the corresponding panel is used. The **Line One Active** or **Line Two Active** indicators turn OFF when the other panel is used.

## **Initialization**

The application must initialize as shown in Figure 1, and the front panel controls and indicators must be in the following states.

- **Tons of Peanuts Knobs:** Set to 0
- **Fill Peanuts:** Enabled
- **Use Peanuts:** Disabled
- **Threshold LEDs and Line Active LEDs:** Set to OFF
- **Process Value:** Set to zero

## **Operation**

### **VI Run**

The VI starts idle.

### **Set the Tons of Peanuts Knob**

The action depends on the new value.

- **Equals 0:** Disable Use Peanuts
- **Equals 10:** Disable Fill Peanuts
- **Equals 1 – 9:** Enable both Use Peanuts and Fill Peanuts

**Press Use Peanuts**

- When the **Use** button is pressed, it must be disabled for 250 ms.
- A random **Process Value** between 0 and 1 is generated and compared against the top threshold limit of 0.75 and the low threshold limit of 0.25.
- The **Above Threshold** or **Below Threshold** LEDs are set to ON/OFF depending on the comparison.
- The random value is displayed in the **Process Value** indicator.
- Disable the **Use** button if **Tons of Peanuts** is zero, enable for all other values.

**Press Fill Peanuts**

- The **Tons of Peanuts** Knob increases by one
- Disable if **Tons of Peanuts** is ten, enable for all other values.

**Questions**

How would the application differ if the requirement was for fourteen hoppers?

How would the application change if the **Use Peanuts** button required some processing times?