


Lab 3 - Arduino Input and Output

Lab 12:30 W 2:00 W 3:30 W
 Section 11:00 F 12:30 F

TA/Instructor initials: _____


Item	Outcome	Score	Max.
Checkpoint <ul style="list-style-type: none"> • Showed that “checkInput” and “makeOutput” work to turn on the LED when a button is pressed 	Yes/No		1
Program Operation <ul style="list-style-type: none"> • Buttons generates ‘U’, ‘S’ and ‘C’ codes • Morse code timing correct (from scope display) • Propagation delay measured (show results below) 	Yes/No		3
	Yes/No		2
	Yes/No		1
Review Questions (graded after submission) <ul style="list-style-type: none"> • Questions below (put answers in Lab3_Answers.txt file and submit on Vocareum) 			4
Code Organization (Graded after submission) <ul style="list-style-type: none"> • Properly indented code • Well-commented code • Provided code to initialize appropriate PORT capabilities • Wrote a correct makeOutput routine • Buttons inputs read and tested properly • Functions used for generating dots and dashes • Delays correct within character • Delay correct after character 	Yes/No		1
	Yes/No		1
	Yes/No		2
	Yes/No		2
	Yes/No		1
	Yes/No		1
	Yes/No		1
	Yes/No		1
Total			21
Open ended comments:			

Propagation delay times:

Maximum delay: _____

Minimum delay: _____

Review Problems

1. (2 points) Suppose we relocated the three buttons from group B, bits 5-3 to group D, bits 5-3, noting that the LED is still attached to group D, bit 2. Assume DDRD has been initialized to the correct values. Consider the following method of turning on the LED.

```
PORTD = 0x04; // turn on the LED
```

Explain the problem with this approach and, in particular, what would stop working after the execution of that line of code.

2. (2 points) Note that in Lab 2 we found that the delay of a NOT gate (hardware only) is around 10ns and this measurement was very consistent. However, the delay measured in this lab is on the order of 10 microseconds (hardware + software) and varies considerably from measurement to measurement. Briefly explain why the delay between the press of the 'C' button and the start of the LED on/off sequence varied when you took multiple measurements.

Hint: ignore the hardware propagation delays which are very small (tens of ns), and think about how your program executes.