Su22-ENGR-40M-01 Prelab 2a

Jannah Sabic El-Rayess

TOTAL POINTS

10 / 10

QUESTION 1

1 P1 1 / 1

✓ - **0 pts** Correct -- (123 and 456 should be together, 2 and 5 should be in middle)

- **0.1 pts** 2 pins mixed up

- **0.3 pts** multiple pins mixed up

- **1 pts** no work / late

QUESTION 2

2 P2 1 / 1

✓ - **0 pts** Correct (Left:Right C:NO:NC)

- **0.2 pts** Mixed up NC and NO pins

- **0.3 pts** Common in wrong place (should be far left)

- **0.1 pts** Didn't label one or more pins (C, NO, or NC)

- **1 pts** No work / Late

QUESTION 3

3 P3 1 / 1

✓ - **0 pts** Correct (common + normally closed)

- **0 pts** Correct pins but incorrect orientation (carry over from P2)

- **0.2 pts** didn't include common pin

- **0.2 pts** incorrectly said normally open

- **1 pts** Incorrect

- **1 pts** no work / late

- **1 pts** Not specified

- **0.2 pts** Correct reasoning but did not specify pins

QUESTION 4

4 P4 1 / 1

✓ - **0 pts** Correct (4.5-4.8V, voltage should go down when motor connected)

- **0.1 pts** 3 batteries should be greater voltage than battery + motor

- **0.2 pts** Measurement out of range

- **0.4 pts** battery pack voltage very off -- values should be near 4.5-4.7V

- **1 pts** no work / late

- **0.2 pts** Only one measurement recorded

QUESTION 5

5 P5 1 / 1

✓ - **0 pts** Correct (45-65mA)

- **0.2 pts** Measurement out of range (current too low or too high)

- **1 pts** no work / late

QUESTION 6

6 P6 1 / 1

✓ - **0 pts** Correct (several hundred mA)

- **0.1 pts** Current too low (said <150mA)

- **0.1 pts** Current too high (said >1A)

- **0.5 pts** Current lower than previous step

- **1 pts** no work / late

- **0.2 pts** Did not give number

QUESTION 7

7 P7 1 / 1

✓ - **0 pts** Correct (diagram or description)

- **0.1 pts** Unclear which way motor is facing

- **0.3 pts** Should be cartoon of motor showing tabs and clockwise direction

- **0.2 pts** directions swapped

- **1 pts** Incorrect

- **1 pts** Description vague or unclear

- **1 pts** no work / late

QUESTION 8

8 P8 3 / 3

✓ - **0 pts** Correct

- **0.25 pts** (+) and (-) of motor not labeled

- **0.25 pts** Limit Switch on wrong path

- **0.1 pts** Limit switch pins not labeled or specified

- **0.25 pts** Motor has wrong polarity or missing
polarity

- **0.25 pts** Error (see comments)

- **0.5 pts** Wrong throw of limit switch connected

- **0.5 pts** Incomplete or disconnected circuit

- **0.5 pts** Limit switch connected to both paths

- **1 pts** Limit switch not included

- **1 pts** Unclear drawing

- **3 pts** Incorrect

- **0.5 pts** toggle switch pins connected incorrectly

- **0.5 pts** Late

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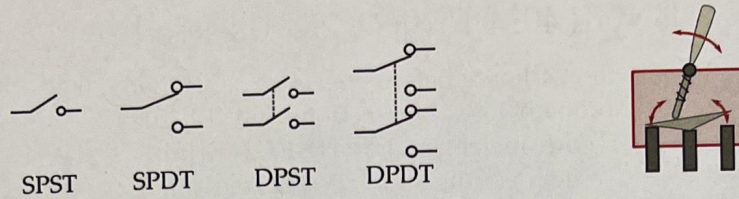
As an aside, the inside of the toggle switch looks something like the diagram to the right. Pushing the switch back and forth flips the rocker between one pair of contacts and the other.

Acrylic sheets. The box itself is made out of Plexiglas, a brand of acrylic sheets. We used a laser cutter to cut the pieces to shape, and the pieces have notches, slots and posts so that they fit together. You'll get the plastic for the boxes when you get to lab. We have a range of colors available.

One word of warning: Plexiglas is very brittle. **If you try to bend it too much, it will shatter.** If things aren't working, please consult your TA.

2 Prelab

Reminder: Prelabs are due on Gradescope 24 hours before your lab, or at the time your TA designates.
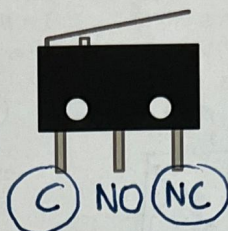
2.1 Characterizing the parts

P1: Probe the toggle switch with your meter to figure out which pins connect to which in each of the switch positions. Based on what you find, label the image below with the pin numbers from the schematic drawing.
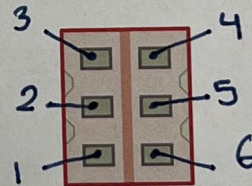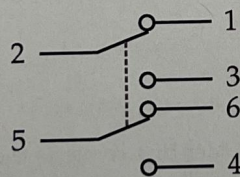
✓ **- 0 pts** **Correct -- (123 and 456 should be together, 2 and 5 should be in middle)**

- 0.1 pts 2 pins mixed up

- 0.3 pts multiple pins mixed up

- 1 pts no work / late

P2: The limit switch is a momentary SPDT switch. Probe the pins with your meter to figure out which pin is the *common* (C) pin (*i.e.* the pole), and which pins are the throws that are respectively *normally open* (NO) and *normally closed* (NC), and mark them on the drawing below.

Only C and NC will be used, not NO for the box.

C   NO   NC

P3: In the useless box we'll only need two of them—indicate which two on the same diagram above. *Hint: when the limit switch is not pressed, i.e. in its "normal" state, do we want the motor to be moving or stopped?*

2.2 Testing the motor

Use your alligator clips to connect to the motor. The motor tabs are very weak, so please be careful when you do this experiment and not tug on the motor leads.

P4: While it's connected to nothing, measure the battery voltage out of your three-AA battery pack. Then, connect the motor directly to the battery and measure the voltage across the motor. How do these two voltages compare?

The battery has 4.80V, but once the motor is connected there is a voltage drop as the voltage is 4.71V. The motor uses up some voltage leading to the drop.

P5: Measure and record the current through the motor when it's connected to your battery pack.

56.8mA

P6: While the motor is powered, try pressing onto the spinning metal shaft on the *end* of the motor. If you press hard enough, you might be able to stop the motor. (If you can't, just press to slow the motor as much as you can without hurting yourself.) What current goes through the motor now?

to stall, press on this metal spinning thing

172.4mA

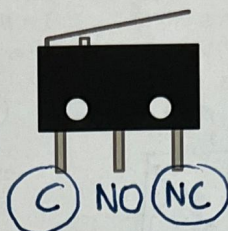**2 P2 1 / 1**

✓ **- 0 pts** Correct (Left:Right C:NO:NC)

- 0.2 pts Mixed up NC and NO pins

- 0.3 pts Common in wrong place (should be far left)

- 0.1 pts Didn't label one or more pins (C, NO, or NC)

- 1 pts No work / Late

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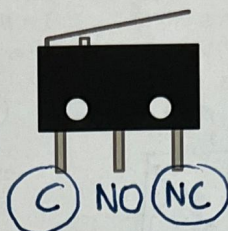
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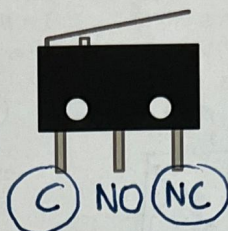
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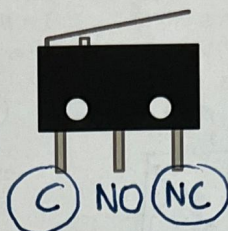
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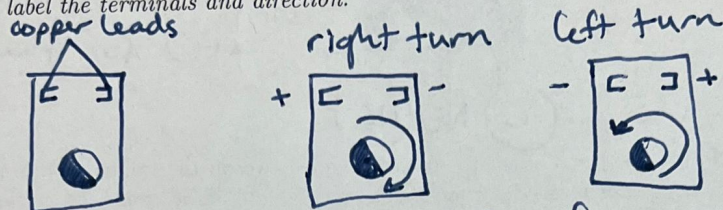
6 P6 **1 / 1**

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   - 0.1 pts Current too high (said >1A)

   - 0.5 pts Current lower than previous step

   - 1 pts no work / late

   - 0.2 pts Did not give number

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P7: Figure out how to control the direction of the motor. Label the pins of the motor and the direction that the motor turns in a way you can remember, since this will be critical when you assemble your box!
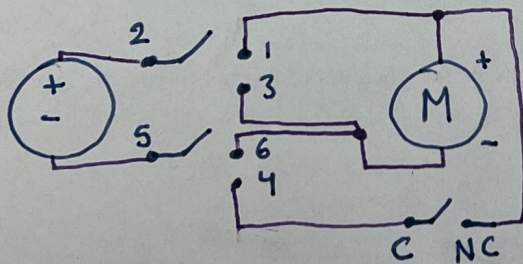
Someone looking at your answer should know which way to connect the motor to make it spin in a desired direction, without having to try it out themselves. In the past, many students have drawn a simple picture of their motor, to make clear which way the motor is oriented when they label the terminals and direction.

while the copper leads face you, if the left lead is connected to the + side of the battery, the motor turns to the right, otherwise it turns to the left.

2.3 Circuit design

P8: Now that you have figured out how the switches are connected, and which polarity causes the motor to turn clockwise, you should be ready to draw a schematic to show how you will connect the batteries, motor, and switches to make the useless box perform its function. The toggle switch is DPDT; the limit switch is an SPDT. Use the circuit symbols you know for the battery and switches.
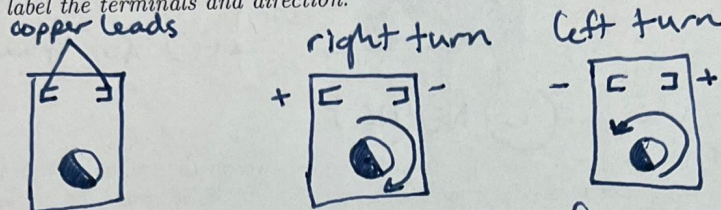
7 P7 **1 / 1**

✓ **- 0 pts** Correct (diagram or description)

- **0.1 pts** Unclear which way motor is facing

- **0.3 pts** Should be cartoon of motor showing tabs and clockwise direction

- **0.2 pts** directions swapped

- **1 pts** Incorrect

- **1 pts** Description vague or unclear

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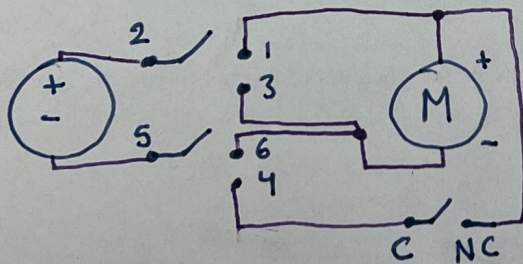
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8 P8 **3 / 3**

✓ **- 0 pts** Correct

    - 0.25 pts (+) and (-) of motor not labeled

    - 0.25 pts Limit Switch on wrong path

    - 0.1 pts Limit switch pins not labeled or specified

    - 0.25 pts Motor has wrong polarity or missing polarity

    - 0.25 pts Error (see comments)

    - 0.5 pts Wrong throw of limit switch connected

    - 0.5 pts Incomplete or disconnected circuit

    - 0.5 pts Limit switch connected to both paths

    - 1 pts Limit switch not included

    - 1 pts Unclear drawing

    - 3 pts Incorrect

    - 0.5 pts toggle switch pins connected incorrectly

    - 0.5 pts Late

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