Name: Dan Kelly

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 43/100 = D+

Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

An embedded system is a computer system that has a itself that has inputs outputs, memory and a processing unit. the difference between embedded & on-a-chip is that on a chip has more of a general purpose. Embedded is the whole part of it while system on a chip is what is used to make the embedded system work.

12

Vague

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

Version control allows people to collaborate instead of doing more individual. It allows them to be one place for it all to go and stay rather than coming from many other places. It reduces the amount of error and causes less delay between people. You can see who did what and can't overwrite other people especially if you can't change things until someone else does their part

20

incomplete

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin**.

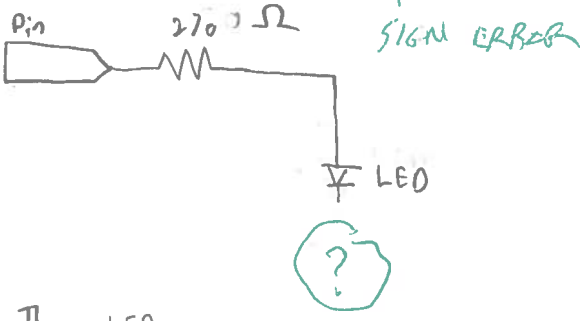
The Raspberry Pi uses 3.3 V logic meaning that. . .
a logic-0 will be somewhere between 0 V and 0.6 V and. . .
a logic-1 will be somewhere between 2.3 V and 3.3 V.

The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)

$3.3 - 1.2 = 2.1\text{V} + .6\text{V} = \frac{2.7\text{V}}{10\text{mA}} = 270\ \Omega$

SIGN ERROR



8

The LED uses power to make it run but needs to be subtracted from the source. If we don't factor in a resistance it will burn out. So, we divide by 10mA to get the resistance needed. The 3.3 - 1.2 is for the LED but the .6 is for the logic level of 0 causing it to be within the range of logic 1.

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?

Not sure if resistors are needed or if need ground.

The pin should be configured through digitalRead(). This way it will know if the pin is high or low. When pushed it will signal a High and add to the count. In order to not go for more than one per press it will need to go through the whole cycle before adding to the count, it must go Low to High & then to low so it does not just stay on high and add to the entire count on one press.

Bounces will do this

3

Name: Patrick Munsey

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 82/100 = A-

Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

Embedded systems are a set of chips that include a main micro controller and some front end hardware like capacitors or op Amps. A system-on-a-chip, or SoC, is a micro controller that is more general purpose. Used most commonly in computer devices.

25

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

The big positive of version control is the safeguard against saving over someone else's changes. (i.e. merging) It also saves a company memory space? by only having one saved document in the repository rather than the endless chain of out of date documents that would be saved somewhere each time some one changed the document being emailed around.

This does not explain many of the advantages

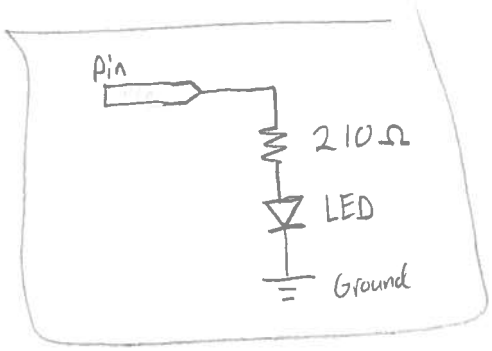
15

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin.**

   The Raspberry Pi uses 3.3 V logic meaning that. . .
   a logic-0 will be somewhere between 0 V and 0.6 V and. . .
   a logic-1 will be somewhere between 2.3 V and 3.3 V.

   The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V). The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

   You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)



$3.3 - 1.2 = 2.1\ V$

$(2.1\ V)/(10\ mA) = 0.21\ k\Omega = 210\ \Omega$

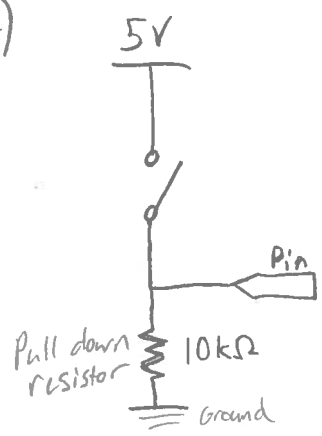
PIN DOES NOT HAVE ENOUGH DRIVE CURRENT AVAILABLE

17

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?

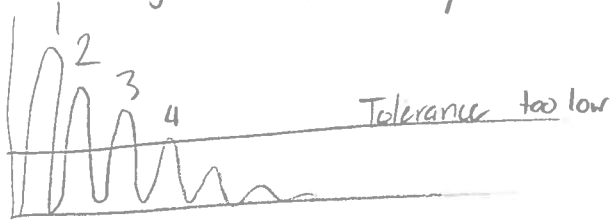
a)

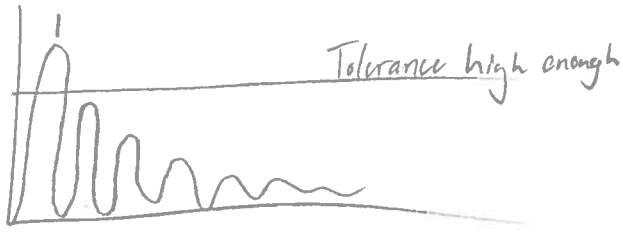


b) The pin will only read high when the button is pushed. so it should be configured and programmed to increase an internal count with every press.

c) To debounce the button, the easiest method would be to include a down time in your configuration. This would allow your program to read the first push and ignore the bouncing afterwards. There are issues with this solution though as a depressed button would add counts after each timer duration since the pin is still reading High. Other methods include trimming the noise of the bounce with filtering or by increasing the tolerance for a High reading as shown below. This is difficult to set correctly though and could still result in multiple counts if button is indefinitely depressed. This hold down issue can be fixed by a clock only looking for changes in state of pin rather than pin state alone.

25





Name: Lucas Nelson

Dordt University Engineering Department

100/100 = A

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020.
Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

From the Preface of the book → It is a computer that is not easily visible. It is not understood as a computer. An embedded system generally has specific purposes. Generally, an embedded system collects data of some kind through a variety of things, such as buttons or sensors, and then evaluates the data and makes a decision that affects the environment around it. An embedded system is different from a system-on-a-chip because a system-on-a-chip has more functions and focuses more on the electrical hardware and connections. System-on-a-chip operates many different components for many different devices. The embedded system is primarily about one device.

25

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

It allows for people to get the latest updated version of the file whenever they please. They can then work on it and push their version for everyone to get. It also allows for people to work on the same file at the same time. They just need to merge their new updates and then push it back out. Version control also allows for easier debugging. People can form branches off the main branch to fix problems if the need arises and then rejoin their branch to the main branch later on. Version control also makes it easy to go back to previous versions for any possible reason.

25

Version control is better than email because more than one person can work at a time, it is easier to stay organized, and it is easier to review previous versions of the files.

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin**.

The Raspberry Pi uses 3.3 V logic meaning that. . .
a logic-0 will be somewhere between 0 V and 0.6 V and. . .
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The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

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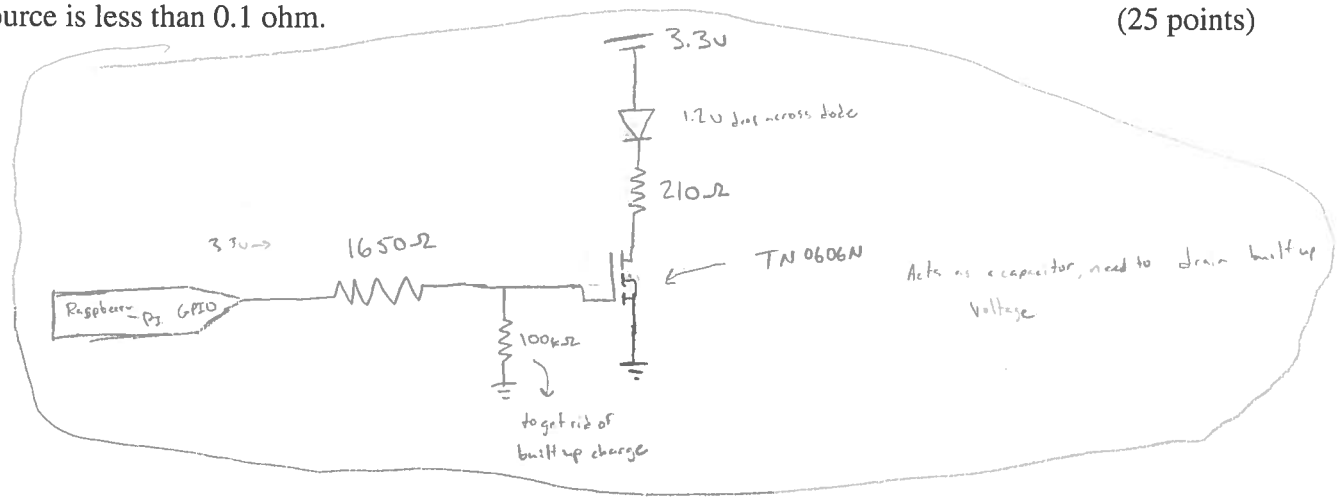


25

$V = IR$

$3.3_V = 2mA \times R$

$\frac{3.3V}{2\times10^{-3}} = 1650\Omega$

1.2V drop across diode

$3.3 - 1.2 = 2.1$ V left to drop

only need 10 mA to drop remaining voltage

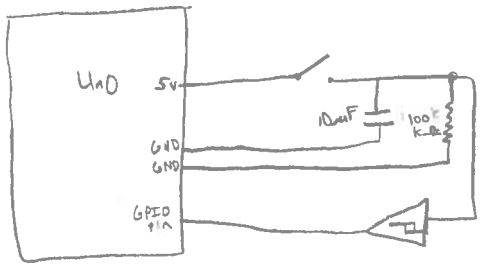
$2.1V = 10mA \cdot R$

$\frac{2.1}{10\times10^{-3}} = 210\Omega$

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?

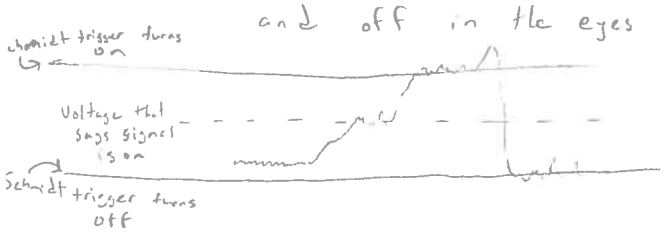
a)



b) Pin will be configured as an input, increment up 1 everytime a signal is received. Ie if pin is high, increment up by one

25

c) The use of the schmidt trigger and capacitor will act as a debouncing technique so that when the button is pushed the signal does not rapidly cycle on and off in the eyes of the arduino. So if signal looked like this



only one button push would be registered.

Name: Zachary Sanford

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 78/100 = A-

Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

- The term embedded system means a collection of combinational computer processors, computer memory, input/output peripheral devices. It is a combination of hardware and software that has a specific function with-in a larger system. Can include user interfaces or not necessarily. Can be used or changed functions easily Not percieved as a computer. Equipt with just enough things to get the job done.

25

- This is different from a system-on-a-chip because a direct function for running on program. It can have I/O and user interface but typically a general purpose application. Once it's programmed can't go back to change it, or you don't want to.

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

Version control is nice because you can have many people working on one file at a time. It takes the files and updates them to merge the code. There are two types

Centralized - this means one person has the "editing" file while others can "view" the file. Organized Risk because only one copy is exsistant.

25

Distributed - there are many copies being worked on, but no one has the most updated. Creative Chaos because many ppl are working.

This is better than email because people may take a long time & have to be reminded of the file and the file could be lost.

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin**.

   The Raspberry Pi uses 3.3 V logic meaning that. . .
   a logic-0 will be somewhere between 0 V and 0.6 V and. . .
   a logic-1 will be somewhere between 2.3 V and 3.3 V.

   The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

   You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)

0.6
+0.3
0.9

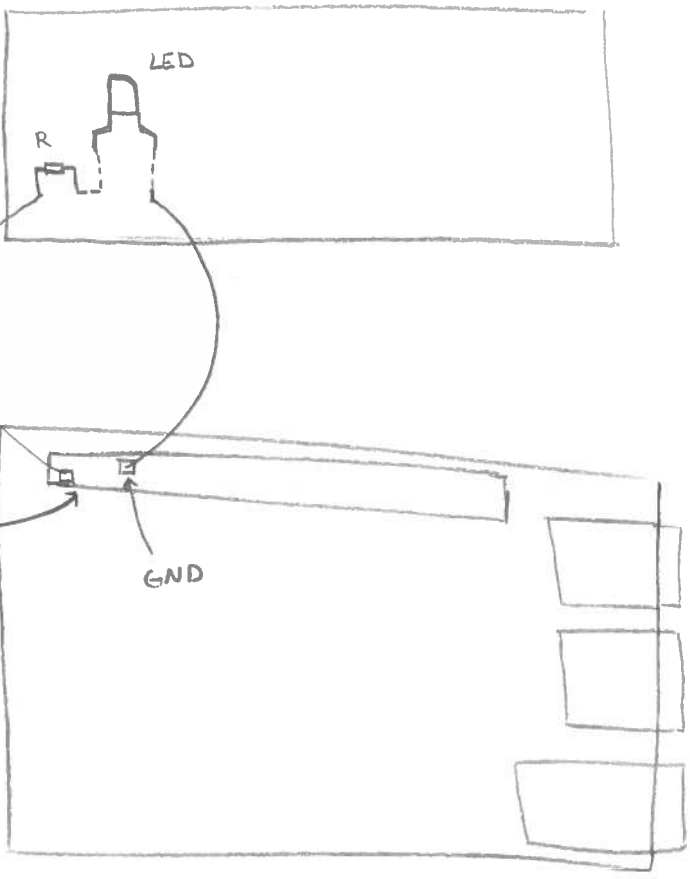
Voltage to

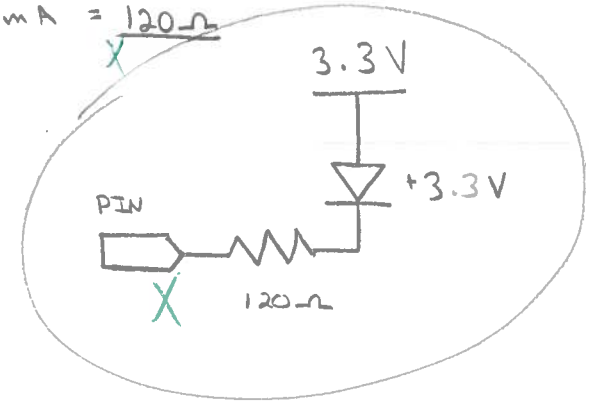
$(3.3V) - V_D - V_{DL} = (3.3V) - (0.9) - (1.2V) = 1.2V$

$R = 1.2V / 10mA = 120\Omega$

$0.9 > 0.6V$

8



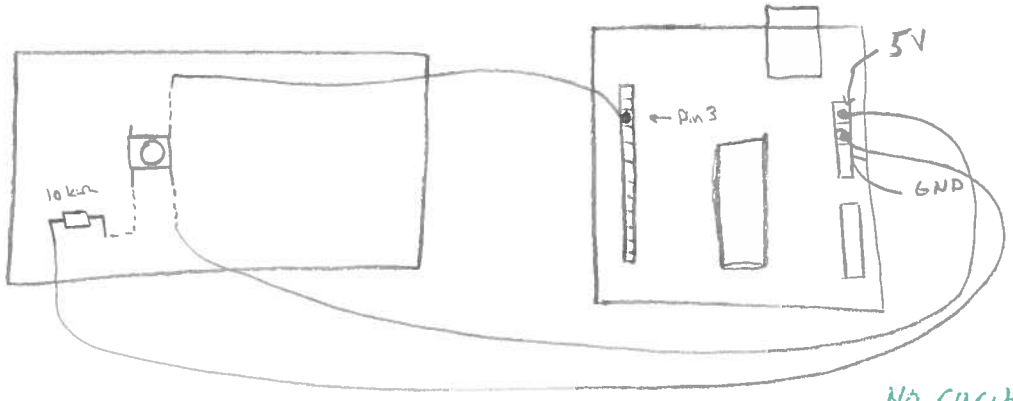


PIN CANNOT PROVIDE NEEDED CURRENT SINK

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

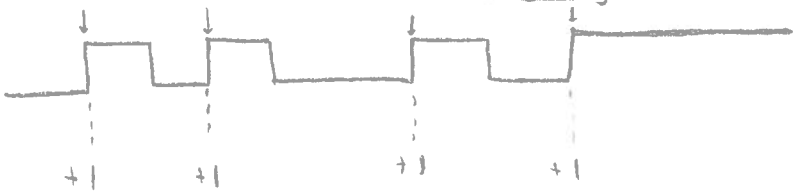
   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?

a.)



b.) I will configure the "Pin 3" as an input Read/Write pin. ? NO SUCH CONFIG. AVAILABLE

I will say that if the button state is HIGH (button pushed) then digitalWrite my count increase by +1. If my button is low then remain. It will count on the rising edge clock.



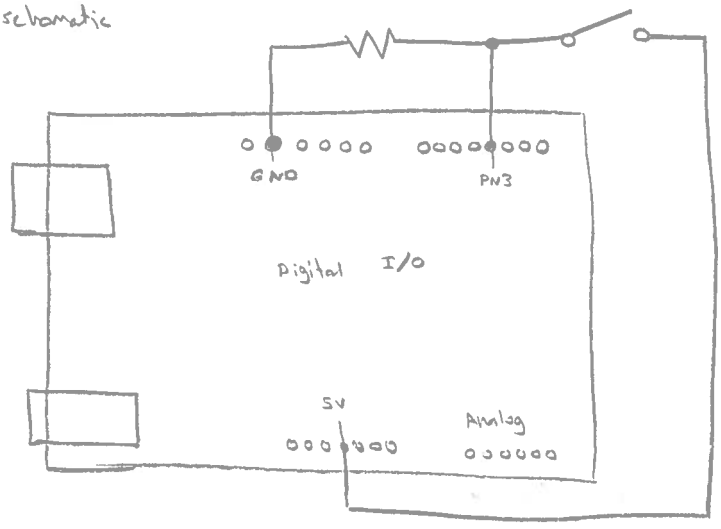
20

c.) I will use a de-bouncing method. Perhaps limit the number of presses with in a few milliseconds. Because no human can press that fast. Vague

Or I will use an anti-aliasing filter to get rid of the noise by analog input (button jiggling).

better schematic on back.

a) better schematic



seen

Name: Shane Tinklenberg

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 85/100 = A-

Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

An embedded system is an electro/mechanica system that exists to fulfill a dedicated purpose. The heart of an embedded system is typically a relatively inexpensive microcontroller (usually less than $1). These 15 microcontroleis have their own Ram, Rom, I/O ports, A/D converter and more. Typically embedded systems seek to control a specific procedure or process. This typically requires reading in data, making a computation and producing an output to some sort of physical interface. incomplete

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

20 Version Control is very beneficial to Software developers, particullarly those who collaborate on projects with other team members or those who work on multiple release versions Sinicl taneously. Take for example a team working on a thermostat. One individual might be responsible for the control loop portion of the code. Another might be responsible for the hardware interfacing and a third might be responsible for the UI. Version control allows each of them to work on their own seperate feature branch simeltaneously and then merge to master when their code is complete/functional. Furthermore, developers may use version control to keep multiple seperate beta branches that are not ready

incomplete

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin.**

The Raspberry Pi uses 3.3 V logic meaning that. . .
a logic-0 will be somewhere between 0 V and 0.6 V and. . .
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The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

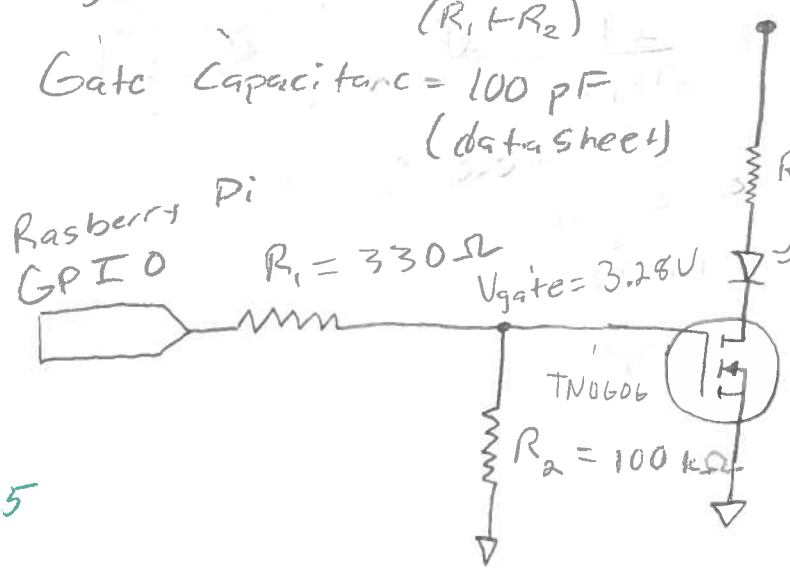
You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n-channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)

$V_{gate} = V_{source} \cdot \frac{R_2}{(R_1 + R_2)}$

+3.3V

N channel mosfet must switch to ground.

Gate Capacitance = 100 pF (datasheet)



$R_{ds(on)} = 0.1\Omega$ (Given)

$V_{GS(th)} = 3V$ (Datasheet)

25

R_1 prevents too large of an in rush current because of the gate capacitance of the FET.

$R_{resistor} = \frac{3.3V - 1.2V}{10 \cdot 10^{-3} A}$

$R_{resistor} = 210\Omega$

R_2 helps pull the gate low when unpowered because of parasitic capacitance on the line/gate.

$R_2 \simeq 100 k\Omega$ = Not too big for a slow time constant.

$R_1 = 330\Omega$ => Max of 10mA inlet current

3.3V / 330Ω =

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
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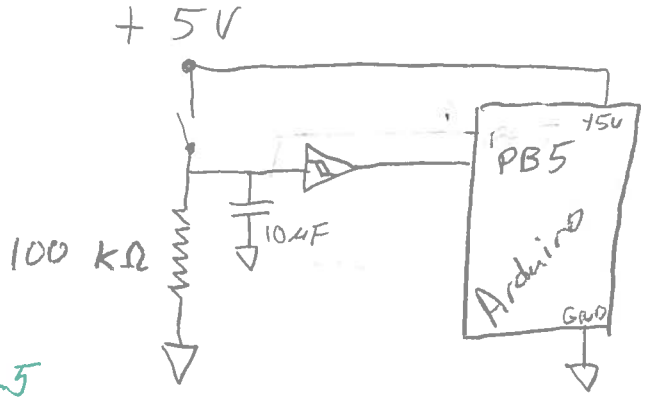
a)



25

b) I would like the pin (PB5) configured as INPUT (no internal pull-up).

c. I would rely on the 10 μF capacitor to ground and the schmitt trigger to produce predictable increments. Assuming the schmitt trigger is an inverter I would attach a falling edge interupt service routine to a function that increments a volatile integer one time for every function call.

Name: Nolan VandeGriend

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 59/100 = B-

Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

PS#1 problem 1

↳ has both memory + capability to do what it needs on "hardwired" → the product alone. nothing more needed/required but at the cost of flexibility. can be slow but is sufficient

22

A weak answer.

~~Software is more important~~

system on a chip can be updated + will deal with things more quickly as it needs to be configured. More customizable for the job at hand but requires slight alterations and does not have memory ~~better~~ so as to ~~focus~~ of processing

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

It keeps a control file as the default and holds onto prior versions in case errors come up down the line. Another benefit is that everyone can see what changes someone else made and it also allows for a central location so you don't have to "hunt" anyone down to get the latest version of the file. Though it can cause problems when people force through incorrect versions as we learned in class. You can also go back to prior versions if you want to change the direction the file is going in so that it is optimized for the job it is required for.

22

incomplete

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin**.

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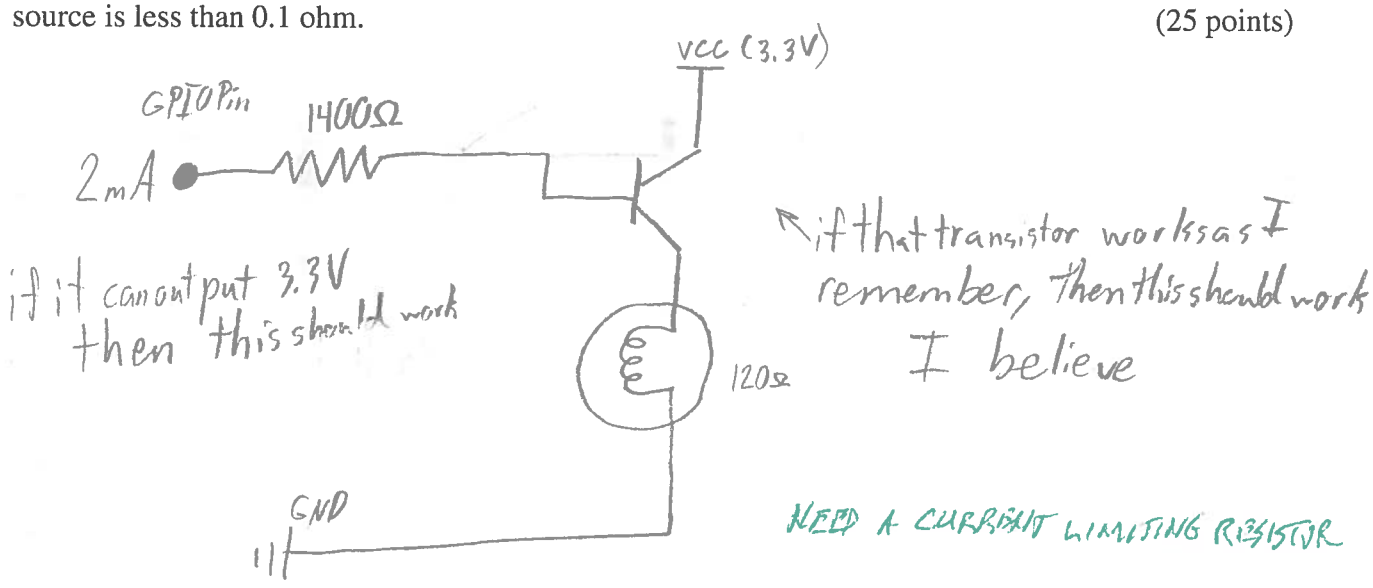
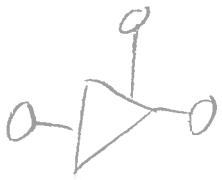
   The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

   You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)



8

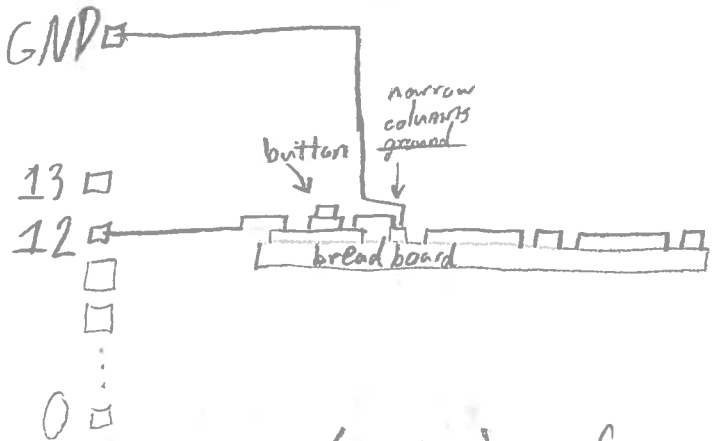
Now you need to switch



4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?

THIS IS A PICTORAL, NOT A SCHEMATIC



NEED A PULL-UP TOO

I want the pin (12 here) configured as an input and the "while loop" to constantly read the value of the ~~arduino~~ pin and since the button will increment on the down press you would want to have it increment the counter by one if the digital read (12) == HIGH. X

7

A way that you would fix the debounce is if you put the while loop reading a statement of first having the read value being low (say for ~30 ms or so) and the if that's true you then have it go to the read value check to see if it's High. if that it true then you can increment. This could obviously be made better but is sufficient for what we have.

SORT OF THE RIGHT IDEA

Name: Matthew VanEpps

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020.
Open notes, an Internet-connected computer is recommended.

93/100 = A

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

An embedded system is essentially a computer that is embedded in some equipment or tool that will run a single program for its life. It has one main function. A thermostat would be an example of an embedded system. It has one specific purpose.

A system on a chip has a more general purpose application. It has more memory and analog functions. Usually contains a cpu in the chip along with enough memory for an almost complete system.

25

A raspberry pi would be an example of a system on a chip. In many ways it acts like a computer running on Linux. It doesn't have to be connected to the internet. It has it's own operating system almost.

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

Version control allows multiple people to work on files from the same repository without losing information. If you email back and forth files, then you will have to manually look at each file and combine new things that another person has edited. Something like Git would do all of the merging for you. Git also keeps track of every commit so if you need to go back and look at an older version of the file you can. Version control will not allow someone to edit a file and then put the file back in the repository if someone else has edited the file before you. It keeps things up to date and merges work so no edits are lost and nothing is missed when merging due to human error. The most important thing is that it allows multiple people to open a file at the same time and edit the file. Once they are finished they can place the file back and be confident that Git will show them if anyone else has edited it so they can then merge their work without ruining anything. Good answer!

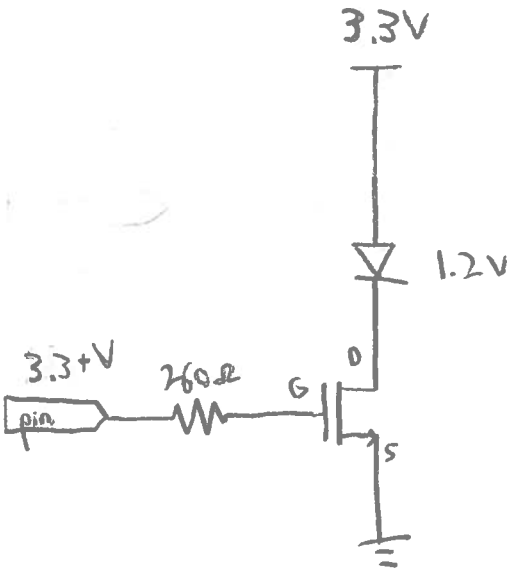
25

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin.**

The Raspberry Pi uses 3.3 V logic meaning that. . .
a logic-0 will be somewhere between 0 V and 0.6 V and. . .
a logic-1 will be somewhere between 2.3 V and 3.3 V.

The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)



10 mA max
5 mA is what we want

$V = V_{pin} - 2.0V$

$V = 3.3 - 2.0$

$V = 1.3V$

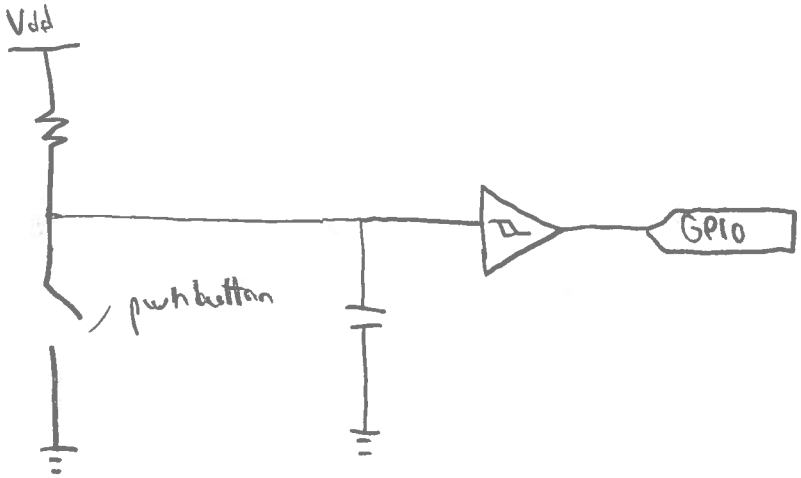
$R = \frac{1.3V}{.005} = 260\,\Omega = R$

18

RESISTOR IS MISSPLACED

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

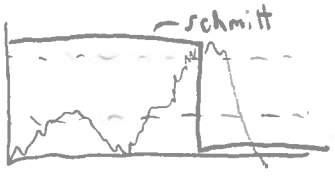
   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?



I would like the pin configured as an input. The pin will be configured negative true because that is how the schmitt trigger works. See bottom of page for reference.

25

Using a schmitt trigger will remove all bouncing of the pushbutton. The schmitt trigger only changes when the voltage goes above or below set voltages. This will give sharp logic transitions so that only one count advances predictably.



Name: Kyle Waw

Dordt University Engineering Department

64/100 = B-

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020.
Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

The embedded system is microcontroller programmed to do a specific tasks. It is not general purpose. The System-on-a-chip is microcontrollers and more components like CPU, it is more general purpose then an embedded system.

25

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

Big files can get messy with very similar title names. The cloud / google has no options besides these applications to work w/ more people. With version control it is much easier to have one file where everyone can access and modify. It will also tell you if the file has been modified by someone else from your download to upload so it's more organized, simple and checks for misplaced errors.

can't read

That's not really the point of version control

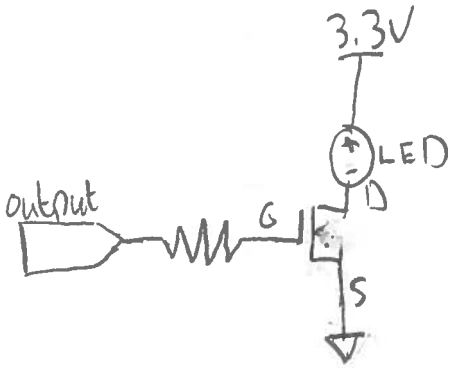
15

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin**.

   The Raspberry Pi uses 3.3 V logic meaning that. . .
   a logic-0 will be somewhere between 0 V and 0.6 V and. . .
   a logic-1 will be somewhere between 2.3 V and 3.3 V.

   The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

   You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)



Couldn't tell if you wanted me to calculate the resistance needed or to just draw the circuit. I just drew the circuit.

8

RESISTOR IS IN WRONG LOCATION

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
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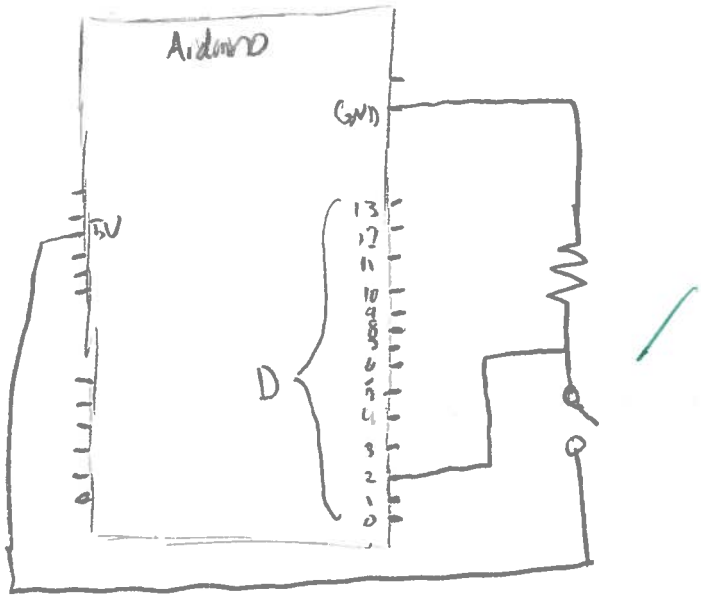
a.)



16

b) make, input for D2. ~~make a todo that~~ will ~~go forward~~. make a state of the button push value. Do an if statement, if HIGH count adds one, otherwise just keep checking

↳ WOULD HAPPEN AS LONG AS BUTTON IS DOWN, NOT ONCE PER PUSH

c) I could set a delay so the button needed time to never. VAGUE

Name: Stefan Walcord

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 87/100 = A-
Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

An embedded system is a computer system with a dedicated function that operates as part of a larger system. It primarily deals with data processing & sometimes aquisition

An SoC is a computer system that runs on a level equivalent to a desktop PC. It has all necessary hardware components and is capable of running independently,

25

Differences

- An SoC is very independently capable, whereas an ES is designed to be embedded and complete/resource powerful ✓
- An ES is designed to process & aquire data as part of a larger whole, whereas an SoC is not primarily designed for data aquisition.
- SOC's are general purpose and high capability, whereas ES are task specific.

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

Version control software keeps track of which version is up to date, allows multiple people to work on code simultaneously, can reconcile disparate changes into a central / distributed version(s), &c. It is "centralized" (even if distributed) capable of roll-backs and branches, and allows branching versions, &c, something email does not offer.

20

incomplete

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin.**

The Raspberry Pi uses 3.3 V logic meaning that. . .
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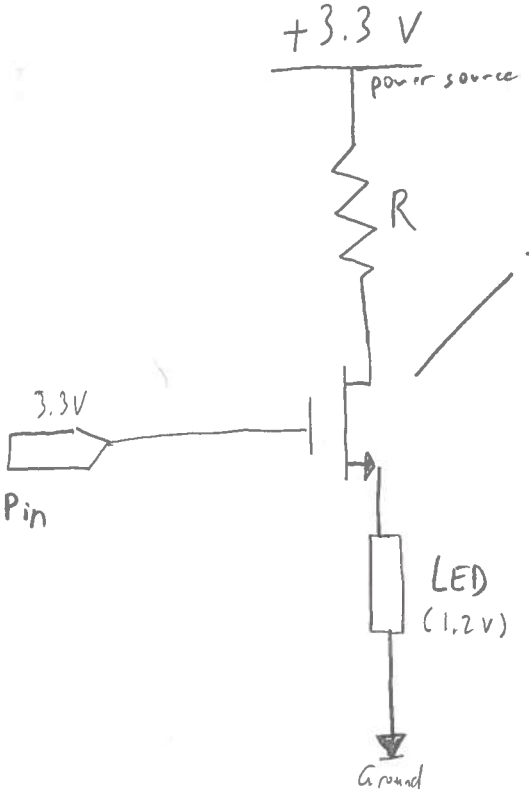
You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. good! If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. nice (25 points)



25

$$\frac{3.3\,V - 1.2\,V}{10\,mA} = 210\,\Omega$$

$R = 210\,\Omega$

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
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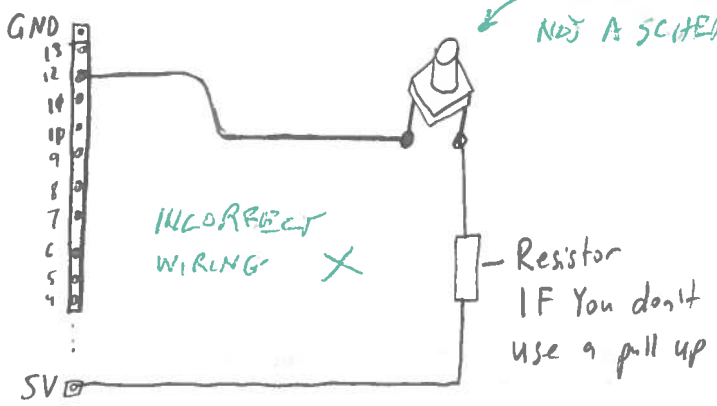
a.)



b.)

Set pin 12 as an input ✓

pinMode (12, INPUT)

When Pin 12 goes HIGH, count

17

c.)

You'll have to debounce it.

The nice, simple debounce method involves counting a reasonable amount of time (say, 50 ms) before we allow another count.

This is called a Software debounce and is the most popular technique. Given that this is a low vibrating, stable system, it should work fairly well. ✓

Name: Ty White

Dordt University Engineering Department

100/100 = A

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020.
Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

1) S.O.C. is a microcontroller that reaches towards general-purpose applications. It tends to have more memory and analog functions. It is the whole package, a GPU, and usually has an O.S. (Raspberry Pi)

2) An embedded system is a computer system with dedicated function within a larger system. For example, automatic lighting system for a room. An example would be an arduino. An embedded system runs one program.

25

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

version control is a topic where a version of software/text/file/document is updated and improved on. It allows collaborators to focus on one detailed part and merge it with updates of other collaborators. When emailing, you must wait for your turn before you can make updates and send it to the next. This in turn would allow for simultaneous collaboration. Version control allows writers to go back to previous versions and create version branches from them. It also tracks every individual change by each writer and helps concurrent work from conflicting.

25

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin**.

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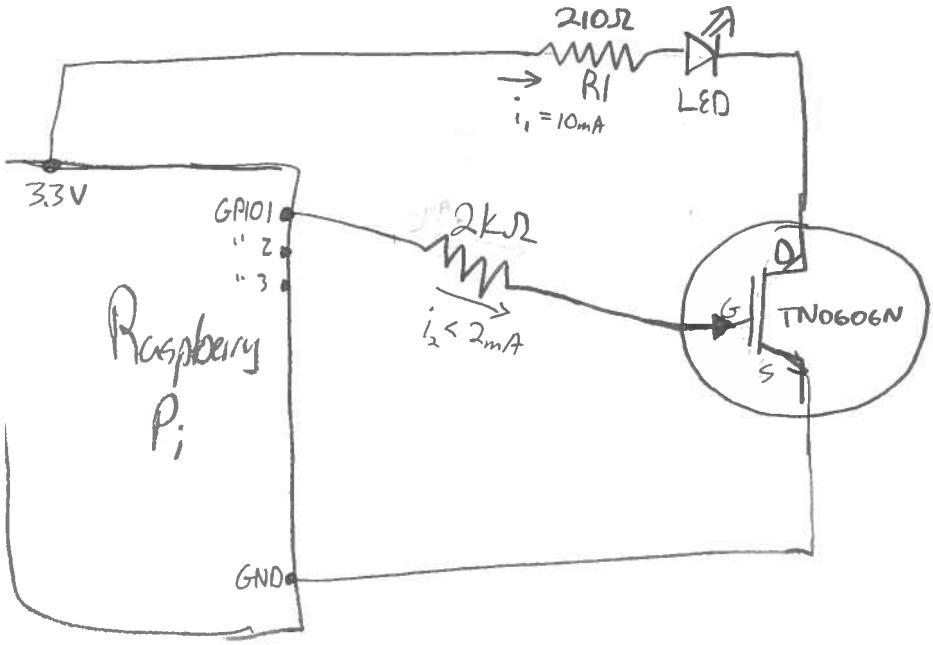

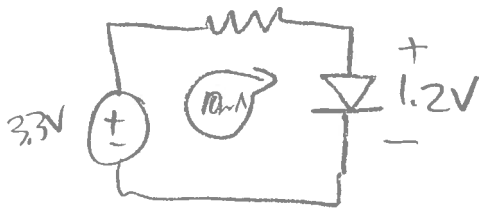

$\Delta V = 3.3 - 1.2 = 10mA\,(R1)$

$R1 = 210\Omega$

25

$3.3V = 2mA\,(R2)$

$R2 = 1650\Omega$

to be safe... $R_2 = 2k\Omega$

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
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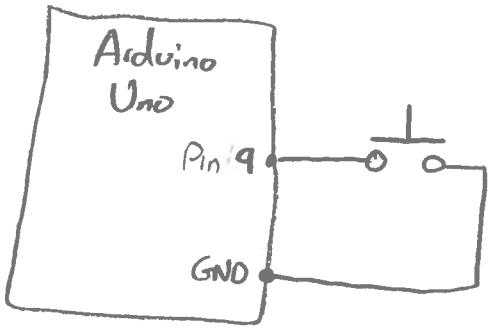
A)



B) pinMode(9, INPUT_PULLUP);

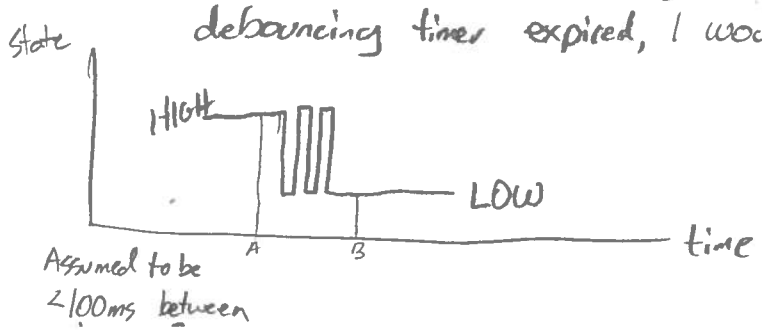
When button pressed, Pin 9 would drop to 0/LOW.

I would use a digitalRead(9) and see if it is low.

25 When released, I'd see it jump back up to its Open Circuit state. I'd have a variable constantly monitoring the state and as soon as the o.c. state changes to 0, it would be pressed.

C) A timeout variable would be used to overcome debouncing. When the button state changes, I'd use millis() to start a timer. this timer would last 100 ms. This way it lasts longer than the debounce time but faster than I could physically press-release-press-release. Each time the state is changed from logic high to low (Button pressed) and the debouncing timer expired, I would iterate the button counter once.

A BIT LONG. I WOULD TRY 30 ms



Name: Charley Young

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 91/100 = A
Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

An embedded system is a computer used for somewhat dedicated purposes and in such a way that the device is not percieved as a computer. It is deviced with just enough resources to get the job done. A system on a chip does not have bear minimum, it fully integrates every component of a computer on a chip like and does not minimize aspects like memory or operating systems like an embedded system.

25

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

It helps us keep track of versions and have the power to revert back to older models. It also highlights differences from one version to another so we can see and know exactly how a file is changing. Often in industry it is necessary for someone to go back and see if an older version of the program will work better for this goal. If it does, then we can isolate which older model helps, and then more aptly compare versions to figure out why. Also when we make changes to versions, often software can merge 2 different changes to the same file quite efficiently based on context. This takes a lot of effort away.

20

incomplete

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin.**

The Raspberry Pi uses 3.3 V logic meaning that. . .
a logic-0 will be somewhere between 0 V and 0.6 V and. . .
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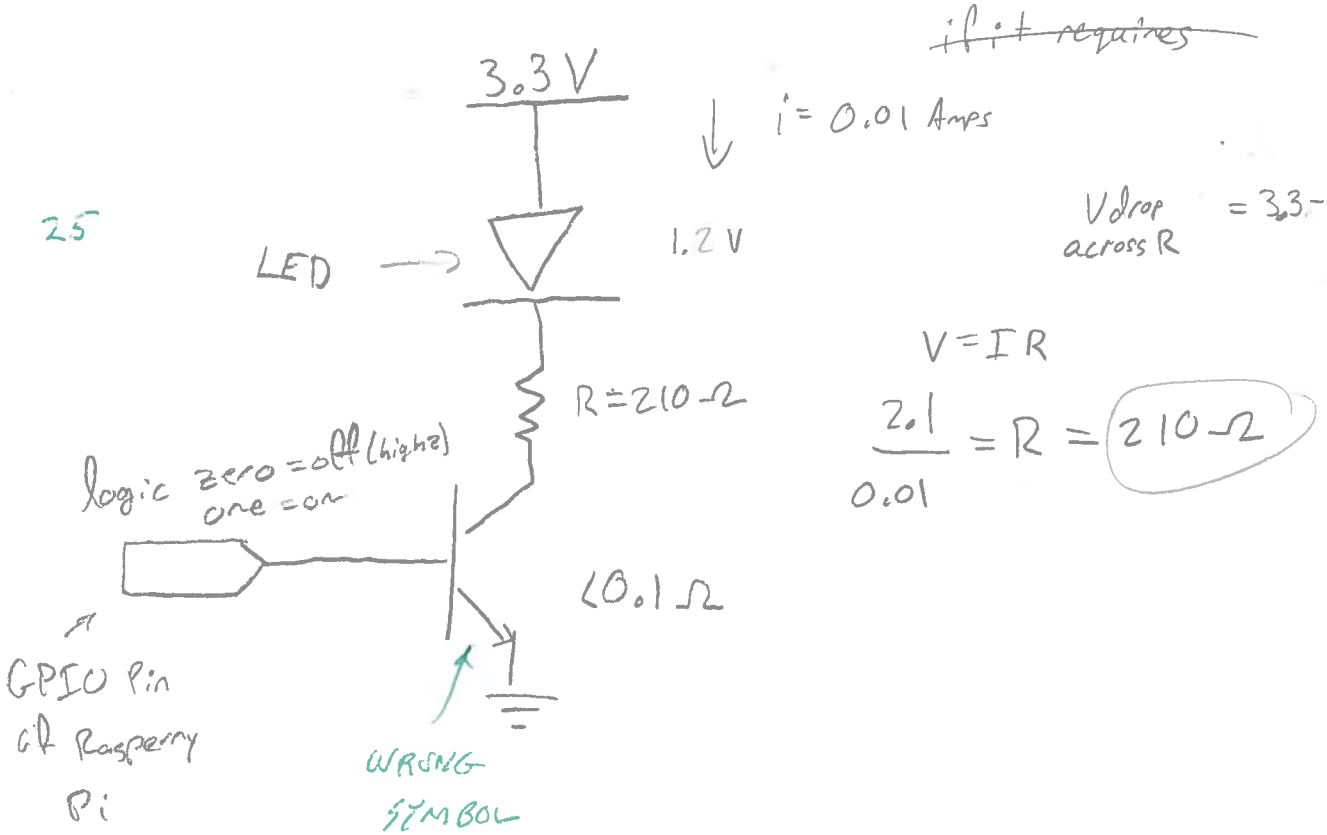
The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)



~~if it requires~~

V drop across R = 3.3 − 1.2 = 2.1 V

V = I R

2.1 / 0.01 = R = 210 Ω

25

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
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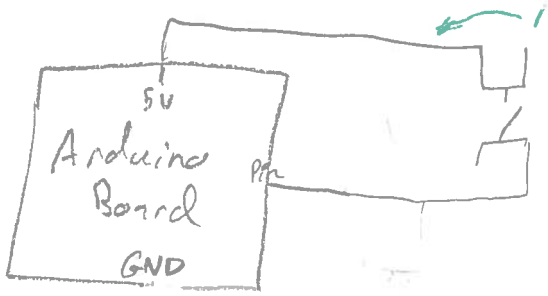
   c.) How will you assure that the count advances predictably and never more than once per press?

a)



b) I would like the pin configured as an input_Pullup. So it will Read a digital input on Pin and the internal resistor can be utilized to read HIGH when the switch is open and Low when it is closed.

2-b

c) The use of the pull up resistor as well as controlling the frequency or rate of checking the state of the pin input. Each time the input pin goes from Low to high (like because of a button press) there will be a minimum time delay between 2 inputs for them to be considered valid and in this way we "debounce" to avoid counting the "miss presses"

Name: Ryan Zevenbergen

Dordt University Engineering Department

EGR 304, Embedded Microprocessor Systems— Test 1, February 21, 2020. 89/100 = A
Open notes, an Internet-connected computer is recommended.

1. What is meant by the phrase, *embedded system*? How is that different from a *system-on-a-chip*? (25 points)

A system-on-a-chip is a microcontroller designed for more general applications. They tend to have more memory and features than other microcontrollers, and are typically found in devices such as laptops and cell phones.

25 An embedded system is more dedicated, serving a specific purpose. It still incorporates processors and memory, but typically I/O signals from other devices. These are typically found in devices such as traffic lights, watches, washing machines, etc.

2. Describe how version control software helps teams of software writers work together. Specifically, why is it better than simply e-mailing files back and forth among the team as needed?. (25 Points)

Without version control, it is very easy to change or undo someone else's work. If two workers are editing the same document, it is possible that the first one to submit their changes will get them overwritten by the second. Version control prevents this by only letting the most recent "version" of a document be editted, else it will send an error. In this case, the second worker would have to pull the latest version, and then make their edits. This is better than emailing because it is more organized and leaves less room for human error, time delays, and other issues.

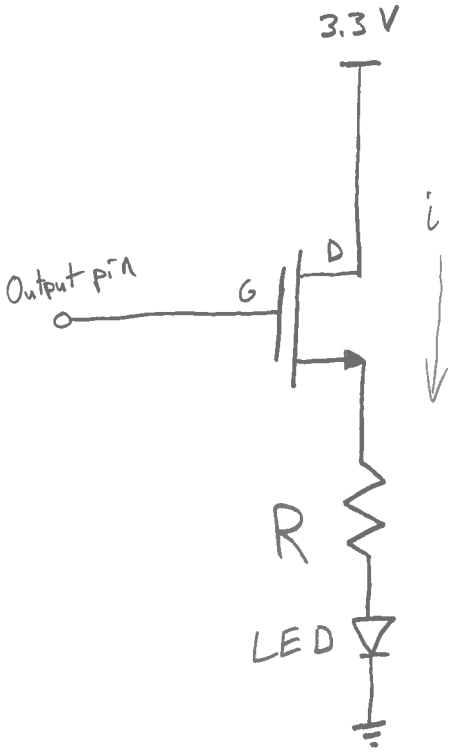
25

3. The certain GPIO pin of a Raspberry Pi evaluation board, when configured as an output, can source or sink no more than a current magnitude of 2 mA. Assuming the GPIO pin is correctly configured as an output, **draw a schematic showing how to control the LED from the output pin.**

   The Raspberry Pi uses 3.3 V logic meaning that. . .
   a logic-0 will be somewhere between 0 V and 0.6 V and. . .
   a logic-1 will be somewhere between 2.3 V and 3.3 V.

   The LED will draw power from the 3.3 V power supply (which you may assume is exactly 3.3 V. The LED has a forward voltage drop of 1.2 V while it is on and requires 10 mA to illuminate.

   You may assume that the 3.3 V power supply, ground, and the GPIO pin can all be conveniently connected to your circuit. You may also assume that any resistors you might want and a TN0606N transistor are available in addition to the LED. The TN0606N transistor is an n–channel enhancement field-effect transistor with a threshold voltage assured to be between 0.6 V and 2.0 V. If the voltage from gate-to-source is less than the threshold you can assume it is "off" and if the voltage is greater than the threshold by at least 0.3 V you can assume the resistance from drain to source is less than 0.1 ohm. (25 points)



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$V_R = 3.3 - 1.2 = 2.1\,V$

$i = 10\,mA$

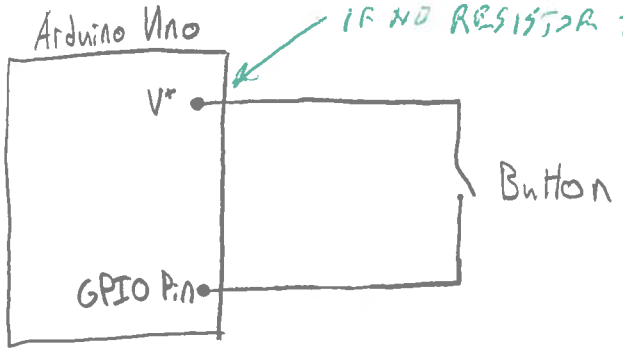
$\frac{2.1}{10\,mA} = R + 0.1$ $\boxed{R = 209.9}$

*R can be a combination of resistors to acheive the correct value, but they must not exceed the value specified, or the current will drop below the threshold to activate the LED.

4. A single spring-loaded pushbutton needs to be connected to a GPIO pin on an Arduino Uno. When the button is pressed down a counter should advance by one count, so that in effect, the number of times the button is pressed is counted from the moment the program starts running. (The count should advance when the button is pressed down, not when it is released.) (25 points)

   a.) Draw a schematic to show how to connect the button to pin of the Arduino Uno.
   b.) Describe how you would like the pin configured. (Words will do, no code needed.)
   c.) How will you assure that the count advances predictably and never more than once per press?

a.)



IF NO RESISTOR YOU MUST CONFIGURE A PULL-UP

b.) The pin will be set up as discrete (digital) input. This way, the pin will be activated on the downward press of the button and the connection is made. When an input is received, the counter is updated.

c.) You could add a while loop that while the button stays pressed, it will not update the counter. The exit condition of this loop would be the negative trigger of the button. so that the counter will be updated on the downward press, but not accept any other changes until the button is lifted.

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