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Calculating sample size

Calculating the sample size of an infinite population

$$n_0 = \frac{Z^2 pq}{e^2}$$

Z represents z score, p is population proportion, q is 1-p, e is the confidence interval

Calculating the sample size of a finite population

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

N represents the target population size

```
In [1]: def sample_size(confidence_level,population_proportion,confidence_interval,population_size):
        from statistics import NormalDist

        alpha = 1-confidence_level
        z_score = NormalDist().inv_cdf(1-alpha/2)
        n_subscript_zero=(z_score**2*population_proportion*(1-population_proportion))/confidence_interval**2
        n = n_subscript_zero/(1+(n_subscript_zero-1)/population_size)
        return round(n)
sample_size(.95,.5,.05,450) # confidence level is 95%, population proportion is unknown, a conservative estimate value of .5 is chosen, confidence interval ±5%, the approximated size of the population is 450
```

Out[1]: 207

207 randomly chosen participants would be the adequate sample size. Unfortunately I do not have access to the emails of the all students of Benedictine University. I instead sent out the survey to people in my classes, approximately 80 Benedictine University students, only 28 responded to the survey.

Survey Questions Results Demographics

This section covers survey results from question 1 to 5

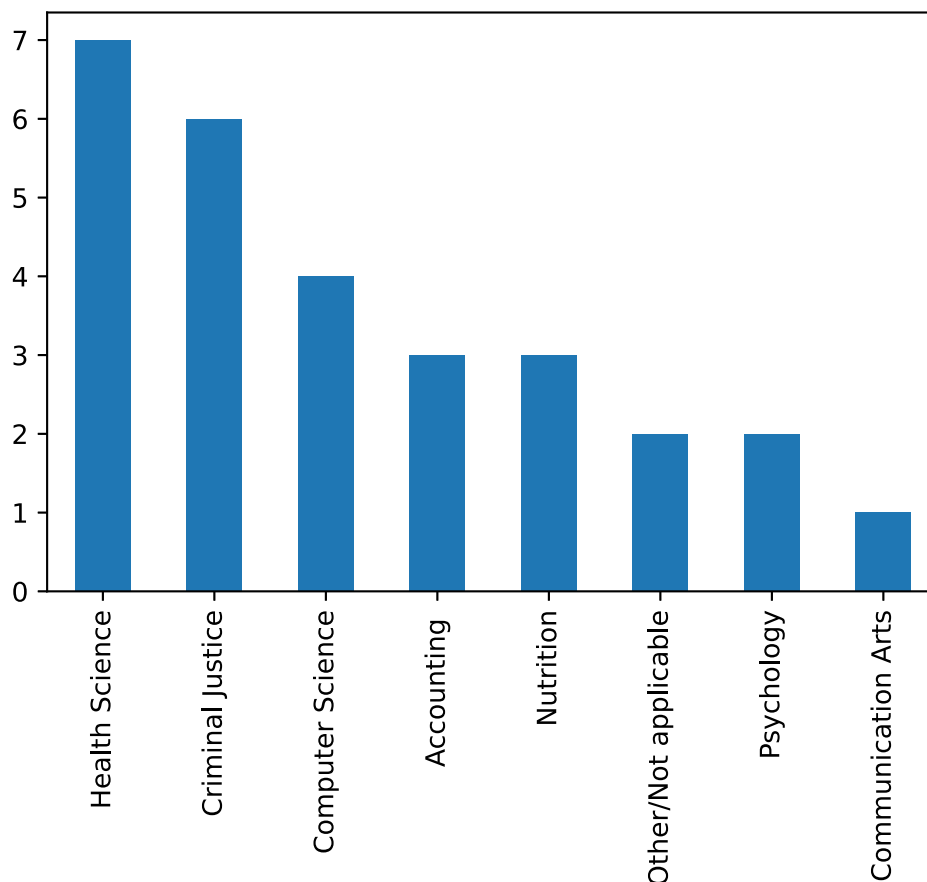
```
In [1]: import pandas as pd
        %matplotlib inline
```

```
In [2]: dataframe = pd.read_excel('Survey_Data_Demographics.xlsx')
        dataframe["Birthdate"] = pd.to_datetime(dataframe["Birthdate"])
        dataframe['Age'] = pd.to_datetime('now').year-dataframe['Birthdate'].dt.year
```

Participants were asked (Question 1) "What is your undergraduate program?"

```
In [3]: dataframe["Undergraduate program"].value_counts().plot.bar() # Below is a bar
        graph from Question 1
```

```
Out[3]: <matplotlib.axes._subplots.AxesSubplot at 0x1a388da29a0>
```



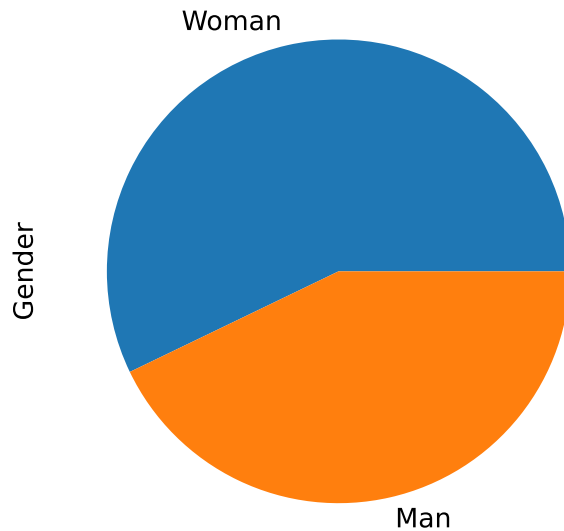
Participants were asked (Question 2) "Gender"

57% participants were woman

43% of participants were men

```
In [4]: dataframe["Gender"].value_counts().plot.pie() # Below is a pie chart from Question 2
```

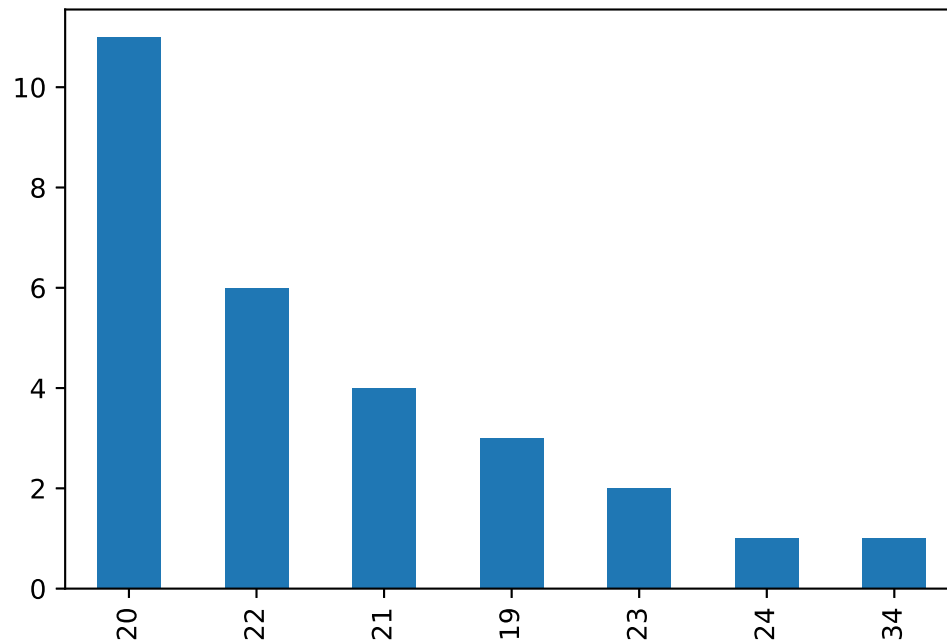
```
Out[4]: <matplotlib.axes._subplots.AxesSubplot at 0x1a388ed46a0>
```



Participants were asked (Question 3) "Birthdate"

```
In [5]: dataframe["Age"].value_counts().plot.bar() # Below is a bar graph from Question 3
```

```
Out[5]: <matplotlib.axes._subplots.AxesSubplot at 0x1a388edbe20>
```



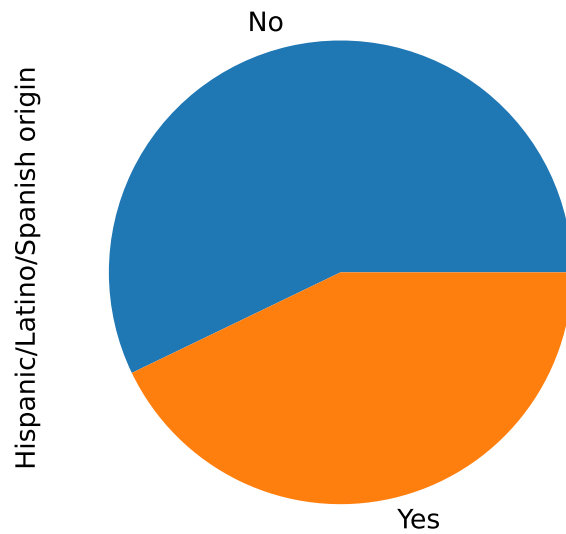
Participants were asked (Question 4) "Are you of Hispanic/Latino/Spanish origin?"

57% of participants responded as not being of Hispanic/Latino/Spanish origin

43% of participants responded as being of Hispanic/Latino/Spanish origin

```
In [6]: dataframe["Hispanic/Latino/Spanish origin"].value_counts().plot.pie() # Below is a pie chart from Question 4
```

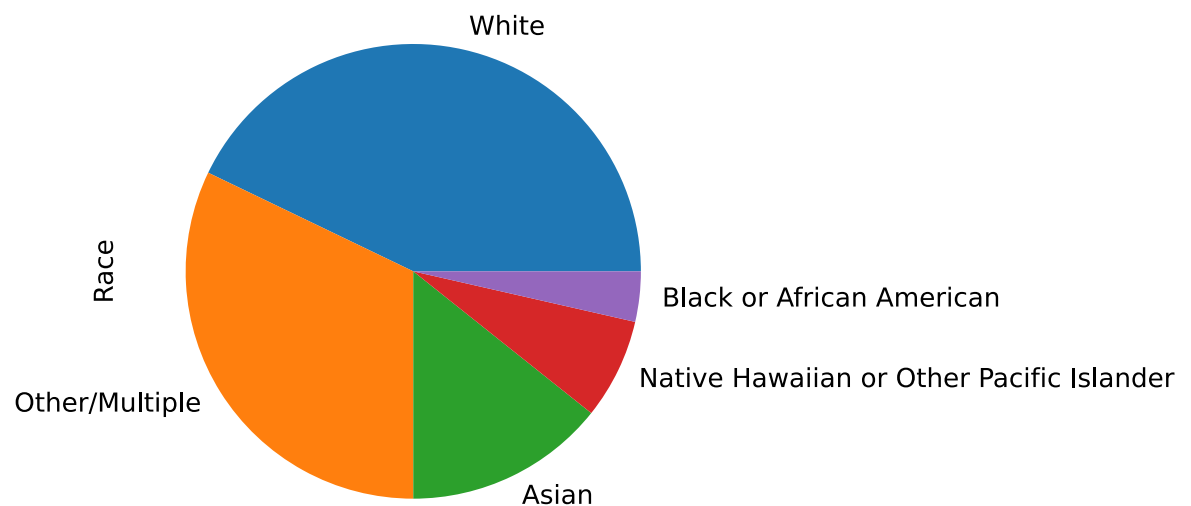
```
Out[6]: <matplotlib.axes._subplots.AxesSubplot at 0x1a388f712e0>
```



Participants were asked (Question 5) "How would you best describe yourself?"

```
In [7]: dataframe["Race"].value_counts().plot.pie() # Below is a pie chart from Question 5
```

```
Out[7]: <matplotlib.axes._subplots.AxesSubplot at 0x1a388fb0d00>
```



Survey Questions Analysis

This section covers the survey results from question 6 to 24

```
In [1]: import pandas as pd  
        %matplotlib inline
```

```
In [2]: dataFrame = pd.read_excel('Survey_Data.xlsx')
```

Participants were asked (Question 6) "On a scale of 1-5, how knowledgeable are you regarding automated technology?"

68% of participants responded with having little to some knowledge regarding automated technology

21% of participants responded with being knowledgeable to very knowledgeable regarding automated technology

11% of participants responded with having no knowledge regarding automated technology

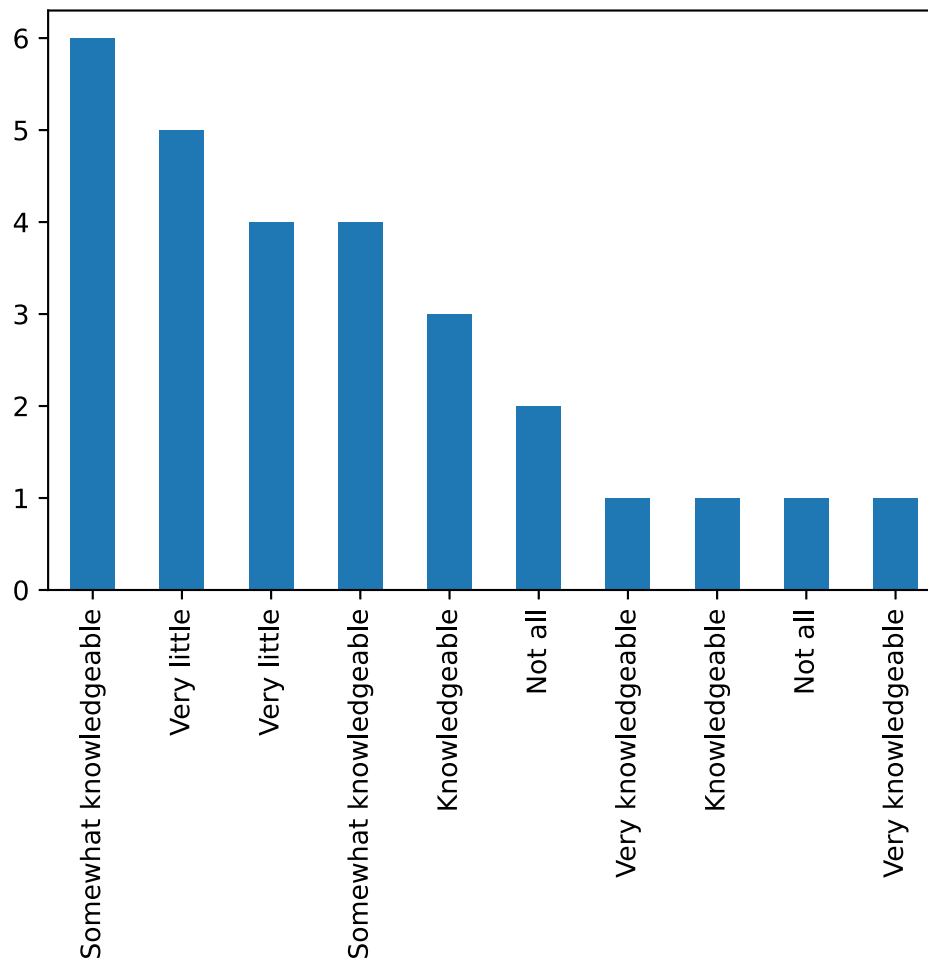
Mean 2.75

Standard deviation 1.0759

The average participant had some knowledge regarding automated technology

```
In [3]: DataFrame["Question 6"].value_counts().plot.bar() # Below is a bar graph from
        Question 6
        # Not all = 1, Very little = 2, Somewhat knowledgeable = 3, Knowledgeable = 4,
        Very knowledgeable = 5 (Used to determine mean and standard deviation)
```

```
Out[3]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b48e8b0>
```



Participants were asked (Question 7) "Do you believe automated technology is important?"

71% of participants believe automated technology is important

25% of participants responded with not knowing whether or not automated technology is important

4% of participants believe automated technology is not important

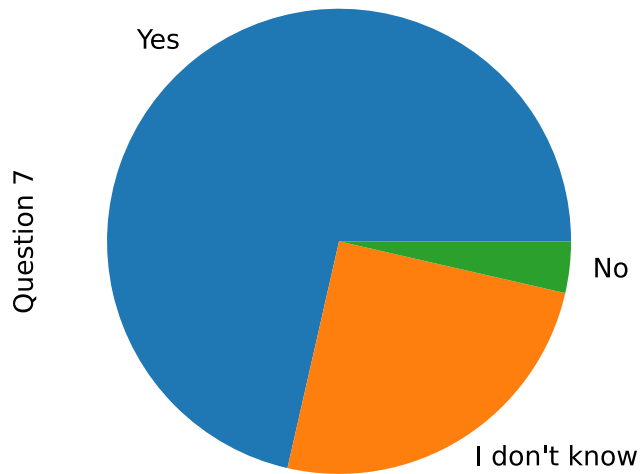
Mean 1.54

Standard deviation 0.8815

The average participant believes automated technology is important


```
In [4]: dataframe["Question 7"].value_counts().plot.pie() # Below is a pie chart from
        Question 7
        # Yes = 1, No = 2, I dont know = 3 (Used to determine mean and standard deviation)
```

```
Out[4]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b5338b0>
```



Participants were asked (Question 8) "Do you believe automated technology has a chance of causing unemployment and higher wealth inequality?"

75% of participants believe automated technology has a chance of causing unemployment and higher wealth inequality

11% of participants believe automated technology does not have a chance of causing unemployment and higher wealth inequality

14% of participants responded with not knowing whether or not automated technology has a chance of causing unemployment and higher wealth inequality

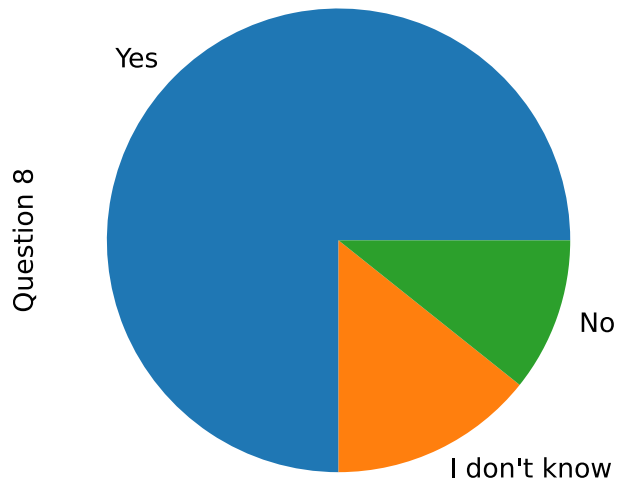
Mean 1.4

Standard deviation 0.7374

The average participant believes automated technology has a chance of causing unemployment and higher wealth inequality

```
In [5]: dataframe["Question 8"].value_counts().plot.pie() # Below is a pie chart from
        Question 8
        # Yes = 1, No = 2, I dont know = 3 (Used to determine mean and standard deviation)
```

```
Out[5]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b5e3c40>
```



Participants were asked (Question 9) "According to the PwC by the mid-2030s one-third of all jobs could face the risk of being automated away. Should regulations and new government assistance programs be introduced to combat wealth inequality and unemployment caused by automation in the near future?"

82% of participants believe regulations and new government assistance programs should be introduced to combat wealth inequality and unemployment caused by automation

7% of participants believe regulations and new government assistance programs should not be introduced to combat wealth inequality and unemployment caused by automation

11% of participants responded with not knowing whether or not regulations and new government assistance programs should be introduced to combat wealth inequality and unemployment caused by automation

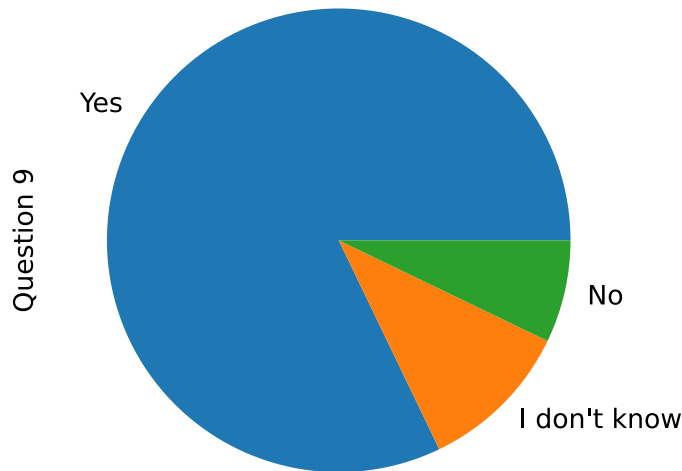
Mean 1.29

Standard deviation 0.6587

The average participant believes regulations and new government assistance programs should be introduced to combat wealth inequality and unemployment caused by automation

```
In [6]: dataframe["Question 9"].value_counts().plot.pie() # Below is a pie chart from
        Question 9
        # Yes = 1, No = 2, I dont know = 3 (Used to determine mean and standard deviation)
```

```
Out[6]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b628460>
```



Participants were asked (Question 10) "How safe do you believe automated technologies are?"

79% of participants believe automated technologies are somewhat safe or neither safe or unsafe

14% of participants believe automated technologies are somewhat unsafe

3.5% of participants believe automated technologies are very safe

3.5% of participants responded with not knowing how safe they believe automated technologies are

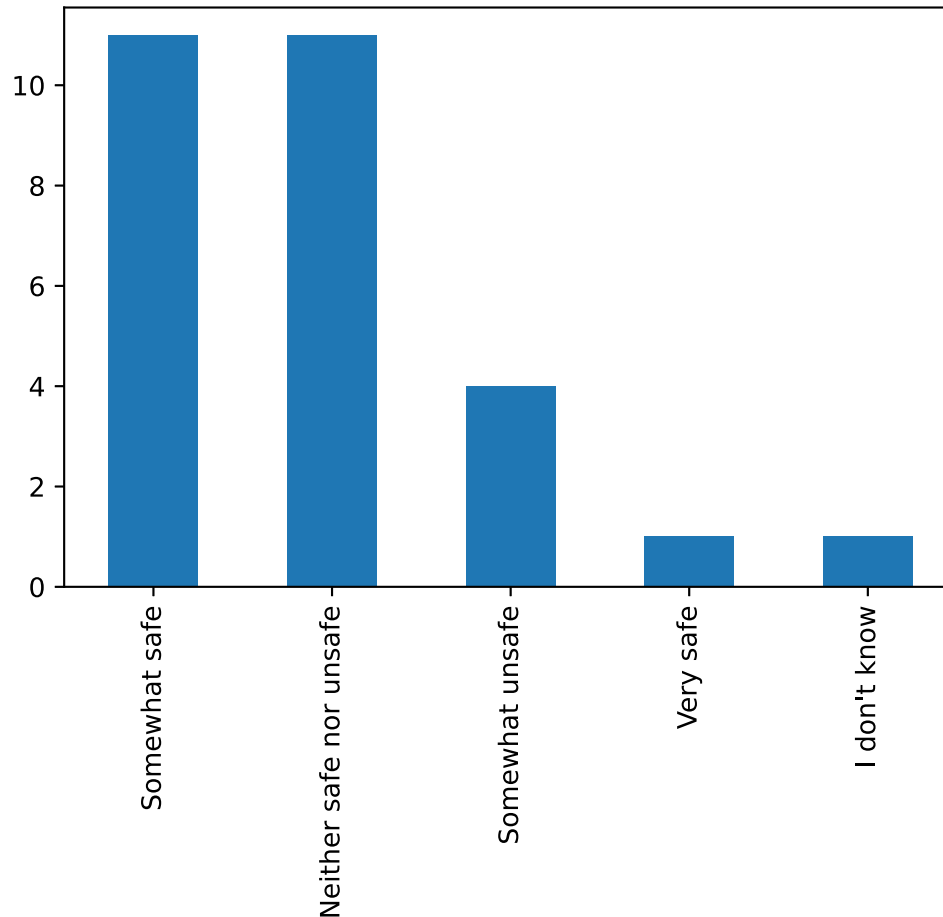
Mean 2.79

Standard deviation 0.9947

The average participant believes automated technologies are somewhat safe, or neither safe or unsafe

```
In [7]: dataframe["Question 10"].value_counts().plot.bar() # Below is a bar graph from
Question 10
# Very safe = 1, Somewhat safe = 2, Neither safe nor unsafe = 3, Somewhat unsafe = 4, Very unsafe = 5, I don't know = 6 (Used to determine mean and standard deviation)
```

```
Out[7]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b66a940>
```



Participants were asked (Question 11) "Have you heard of automated vehicle technologies?"

89% of participants have heard of automated vehicle technologies

11% of participants have not heard of automated vehicle technologies

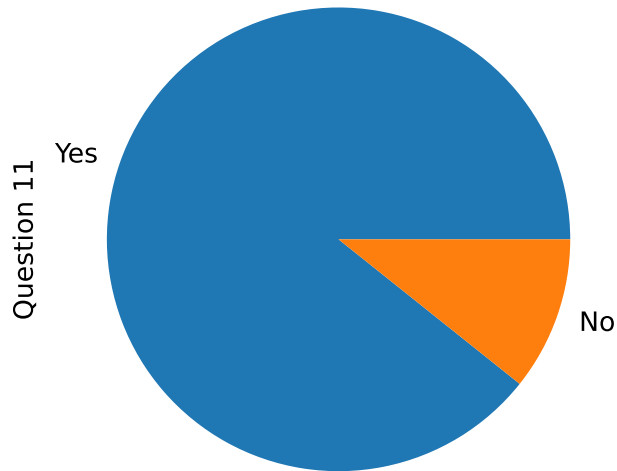
Mean 1.12

Standard deviation 0.3258

The average participant has heard of automated vehicle technologies

```
In [8]: dataframe["Question 11"].value_counts().plot.pie() # Below is a pie chart from  
Question 11  
# Yes = 1, No = 2 (Used to determine mean and standard deviation)
```

```
Out[8]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b6d8460>
```



Participants were asked (Question 12) "Automated vehicles are expected to hit the road within 10-20 years from now. How safe do you feel with the possibility of sharing the road with automated vehicles?"

43% of participants feel somewhat safe with the possibility of sharing the road with automated vehicles

32% of participants feel somewhat unsafe or very unsafe with the possibility of sharing the road with automated vehicles

14% of participants feel neither safe nor unsafe with the possibility of sharing the road with automated vehicles

7% of participants feel very safe with the possibility of sharing the road with automated vehicles

4% of participants responded with not knowing how safe they would feel with the possibility of sharing the road with automated vehicles

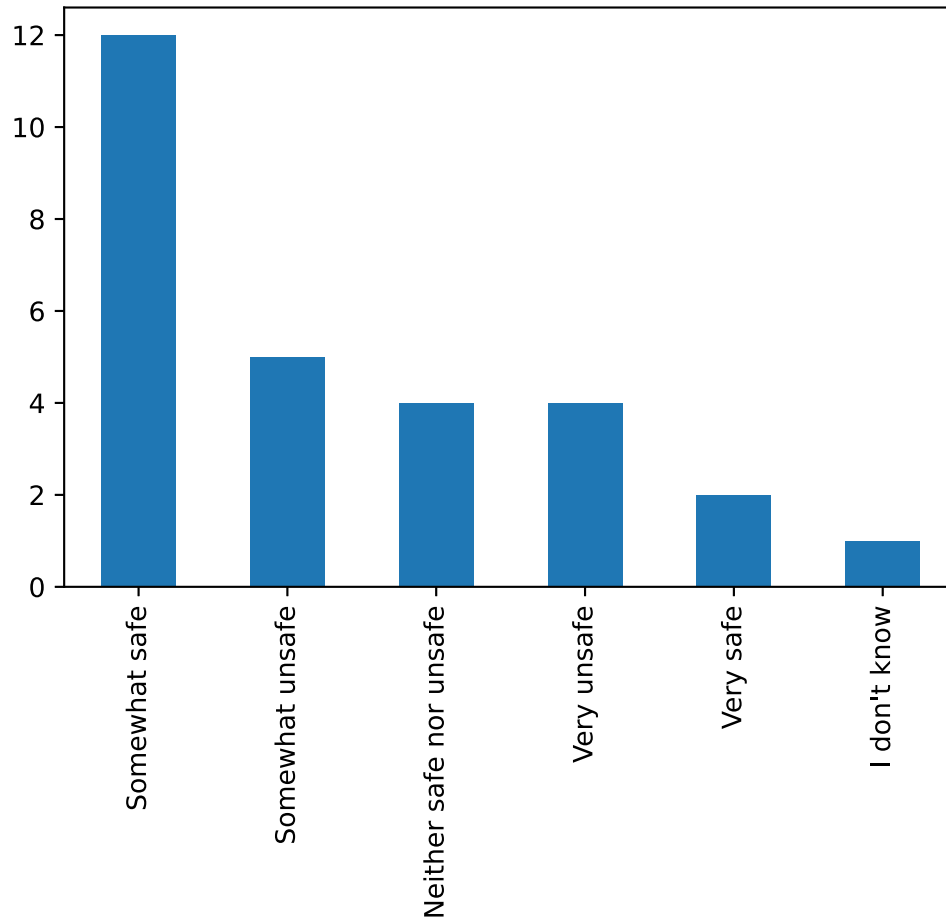
Mean 3

Standard deviation 1.3608

The average participant feels somewhat safe with the possibility of sharing the road with automated vehicles

```
In [9]: DataFrame["Question 12"].value_counts().plot.bar() # Below is a bar graph from
Question 12
# Very safe = 1, Somewhat safe = 2, Neither safe nor unsafe = 3, Somewhat unsafe = 4, Very unsafe = 5, I don't know = 6 (Used to determine mean and standard deviation)
```

```
Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b59f0d0>
```



Participants were asked (Question 13) "How regulated should automated vehicles be?"

57% of participants believe automated vehicles should be very regulated

32% of participants believe automated vehicles should be somewhat regulated

11% of participants believe automated vehicles should be minimally regulated

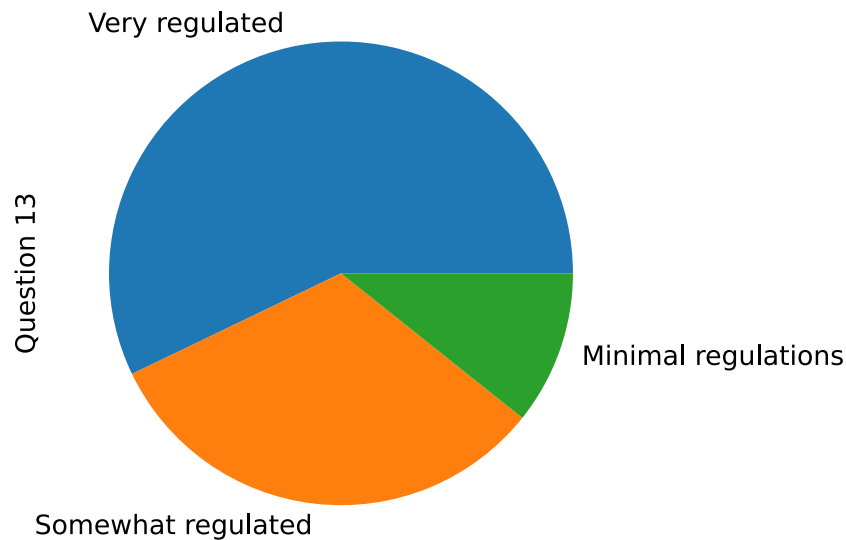
Mean 1.54

Standard deviation 0.6930

The average participant believes automated vehicles should be very regulated

```
In [10]: dataframe["Question 13"].value_counts().plot.pie() # Below is a pie chart from
Question 13
# Very regulated = 1, Somewhat regulated = 2, Minimal regulations = 3 (Used to
determine mean and standard deviation)
```

```
Out[10]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b748190>
```



Participants were asked (Question 14) "How often, when shopping or ordering food, do you use self-service checkout systems or food ordering kiosks?"

36% of participants always use self-service checkout systems or food ordering kiosks when shopping or ordering food

32% of participants very often use self-service checkout systems or food ordering kiosks when shopping or ordering food

18% of participants often use self-service checkout systems or food ordering kiosks when shopping or ordering food

14% of participants never use self-service checkout systems or food ordering kiosks when shopping or ordering food

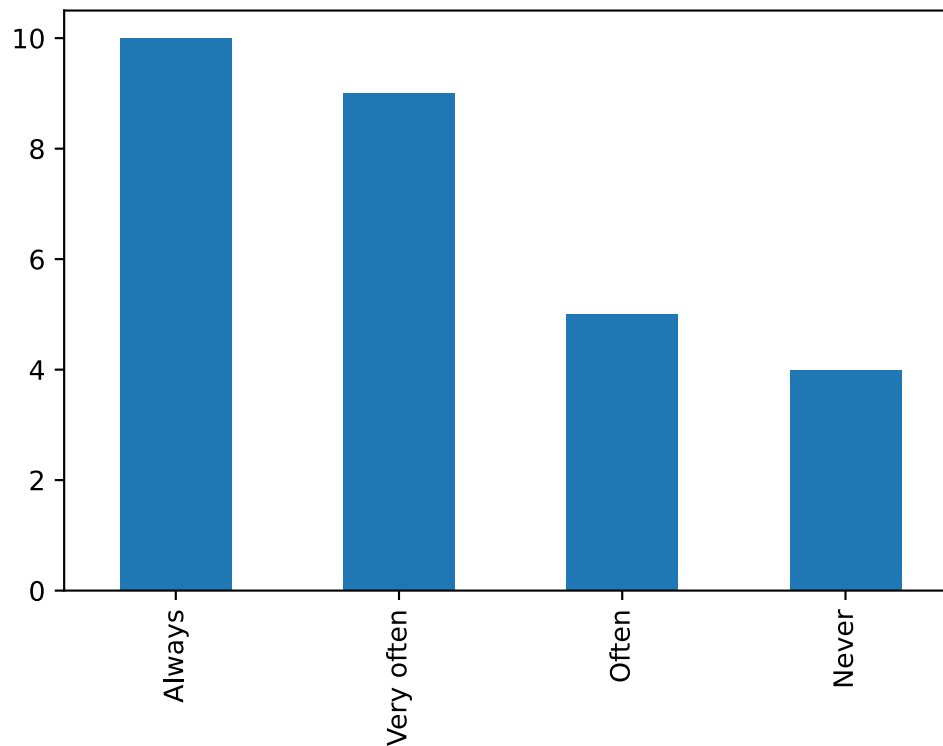
Mean 2.12

Standard deviation 1.0659

The average participant will very often use self-service checkout systems or food ordering kiosks when shopping or ordering food

```
In [11]: dataframe["Question 14"].value_counts().plot.bar() # Below is a bar graph from
Question 14
# Always = 1, Very often = 2, Often = 3, Never = 4 (Used to determine mean and
standard deviation)
```

```
Out[11]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b79ab50>
```



Participants were asked (Question 15) "Have you heard of workerless retail and grocery stores, such as Amazon Go or Moby Mart?"

89% of participants have heard of workerless retail and grocery stores, such as Amazon Go or Moby Mart

11% of participants have not heard of workerless retail and grocery stores, such as Amazon Go or Moby Mart

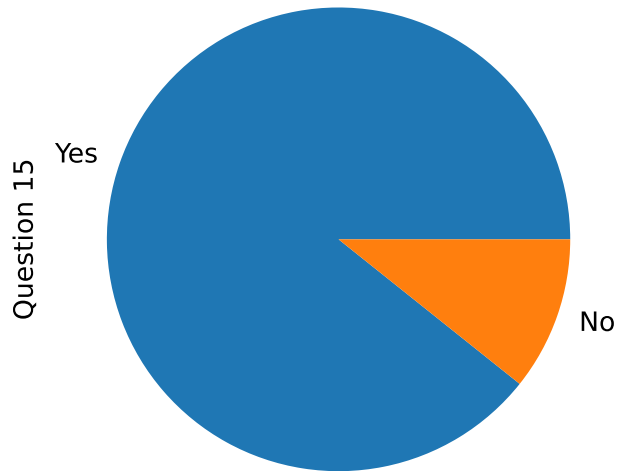
Mean 1.11

Standard deviation 0.3150

The average participant has heard of workerless retail and grocery stores, such as Amazon Go or Moby Mart


```
In [12]: dataframe["Question 15"].value_counts().plot.pie() # Below is a pie chart from  
Question 15  
# Yes = 1, No = 2
```

```
Out[12]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b802400>
```



Participants were asked (Question 16) "How likely are you to shop at workerless retail and grocery stores?"

32% of participants are very unlikely to shop at workerless retail and grocery stores
25% of participants are somewhat likely to shop at workerless retail and grocery stores
21% of participants are very likely to shop at workerless retail and grocery stores
11% of participants are somewhat unlikely to shop at workerless retail and grocery stores
11% of participants are neither likely nor unlikely, or did not know whether or not to shop at workerless retail and grocery stores

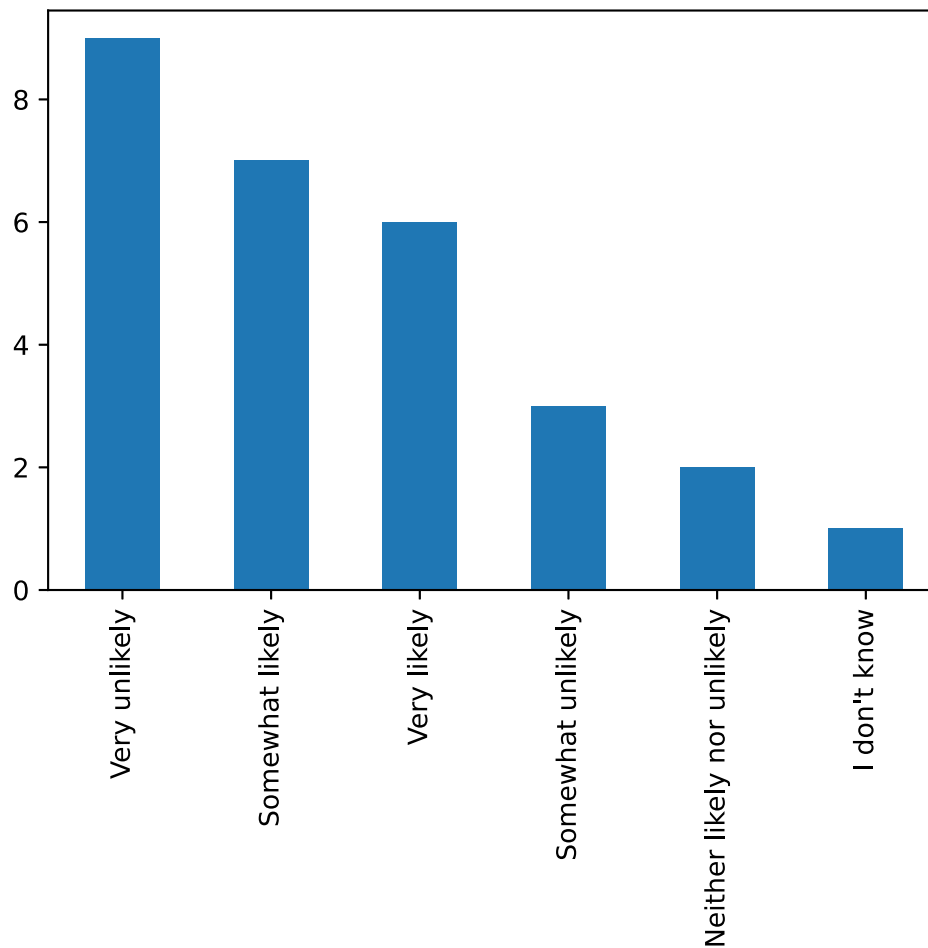
Mean 3.18

Standard deviation 1.7008

The average participant is unlikely to shop at workerless retail and grocery stores

```
In [13]: dataframe["Question 16"].value_counts().plot.bar() # Below is a bar graph from  
Question 16  
# Very likely = 1, Somewhat likely = 2, Neither likely nor unlikely = 3, Somew  
hat unlikely = 4, Very unlikely = 5, I don't know = 6
```

```
Out[13]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b837580>
```



Participants were asked (Question 17) "Do you believe automated grocery and retail stores will have drastic employment effects on low-income retail workers?"

82% of participants believe automated grocery and retail stores will have drastic employment effects on low-income retail workers

11% of participants do not believe automated grocery and retail stores will have drastic employment effects on low-income retail workers

7% of participants do not know whether or not they believe automated grocery and retail stores will have drastic employment effects on low-income retail workers

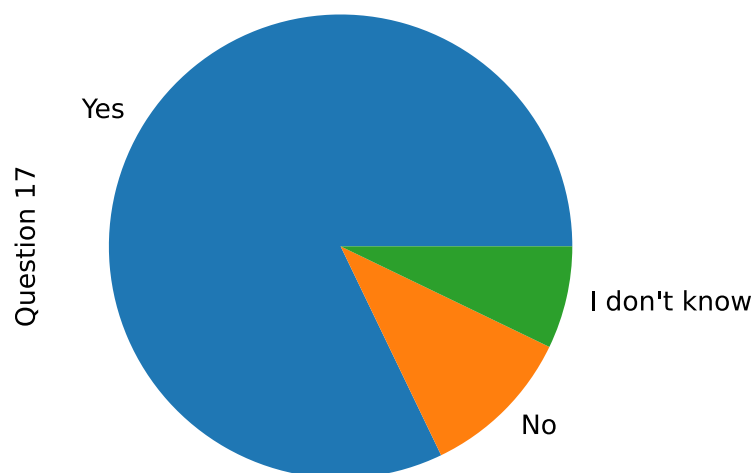
Mean 1.25

Standard deviation 0.5853

The average participant believes automated grocery and retail stores will have drastic employment effects on low-income retail workers

```
In [14]: dataframe["Question 17"].value_counts().plot.pie() # Below is a pie chart from  
Question 17  
# Yes = 1, No = 2, I don't know = 3 (Used to determine mean and standard deviation)
```

```
Out[14]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b8924c0>
```



Participants were asked (Question 18) "Have you heard of facial recognition technology used in drone surveillance?"

82% of participants have heard of facial recognition technology used in drone surveillance

18% of participants have not heard of facial recognition technology used in drone surveillance

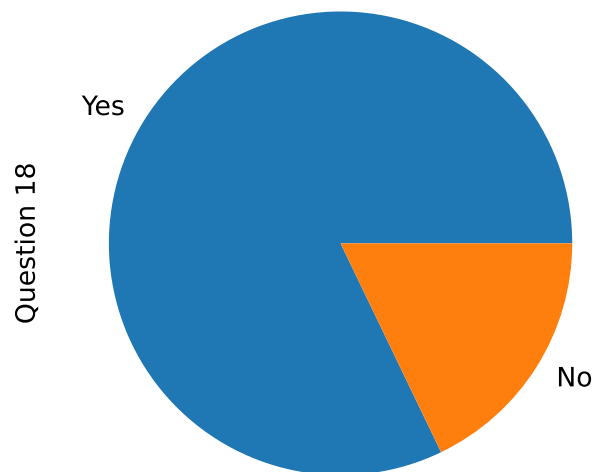
Mean 1.18

Standard deviation 0.3900

The average participant has heard of facial recognition technology used in drone surveillance

```
In [15]: dataframe["Question 18"].value_counts().plot.pie() # Below is a pie chart from  
          Question 18  
          # Yes = 1, No = 2 (Used to determine mean and standard deviation)
```

```
Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b8d6a00>
```



Participants were asked (Question 19) "Should law enforcement and governing bodies have access to facial recognition technologies?"

54% of participants believe law enforcement and governing bodies should have access to facial recognition technologies

21% of participants do not believe law enforcement and governing bodies should have access to facial recognition technologies

25% of participants do not know whether or not law enforcement and governing bodies should have access to facial recognition technologies

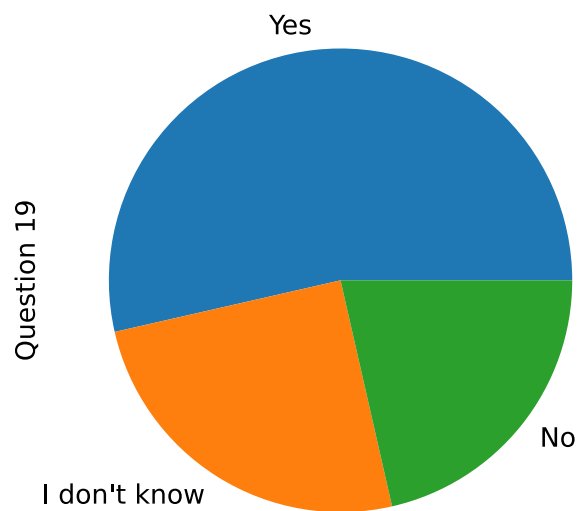
Mean 1.71

Standard deviation 0.8545

The average participant believes law enforcement and governing bodies should have access to facial recognition technologies

```
In [16]: dataframe["Question 19"].value_counts().plot.pie() # Below is a pie chart from  
          Question 19  
          # Yes = 1, No = 2, I don't know = 3 (Used to determine mean and standard deviation)
```

```
Out[16]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8c8e3850>
```



Participants were asked (Question 20) "Is it possible that facial recognition technologies violate our right to privacy?"

64% of participants believe that it is possible that facial recognition technologies violate our right to privacy
22% of participants do not believe that it is possible that facial recognition technologies violate our right to privacy
14% of participants do not know whether or not they believe that it is possible that facial recognition technologies violate our right to privacy

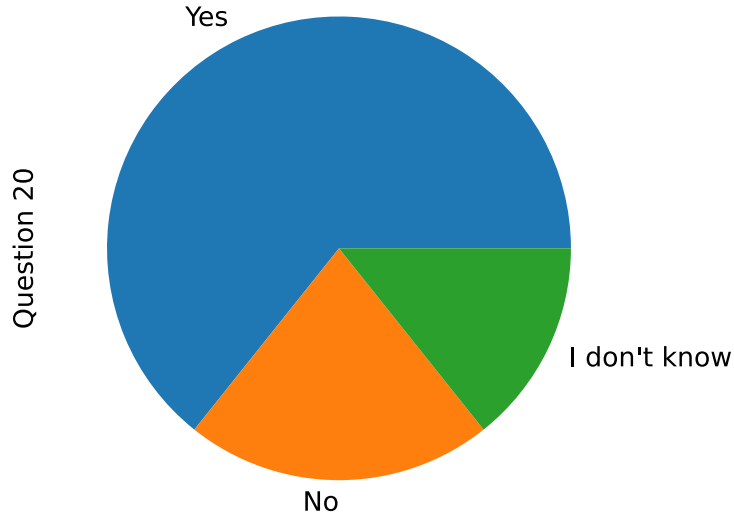
Mean 1.5

Standard deviation 0.7454

The average participant believes that it is possible that facial recognition technologies violate our right to privacy

```
In [17]: dataframe["Question 20"].value_counts().plot.pie() # Below is a pie chart from
Question 20
# Yes = 1, No = 2, I don't know = 3 (Used to determine mean and standard deviation)
```

```
Out[17]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8c920d00>
```



Participants were asked (Question 21) "How satisfied are you with government regulations on automated technology?"

68% of participants are neither satisfied nor dissatisfied with government regulations on automated technology

14% of participants are somewhat satisfied with government regulations on automated technology

10% of participants are somewhat dissatisfied to very dissatisfied with government regulations on automated technology

8% of participants were either very satisfied or did not know whether or not they were satisfied or unsatisfied with government regulations on automated technology

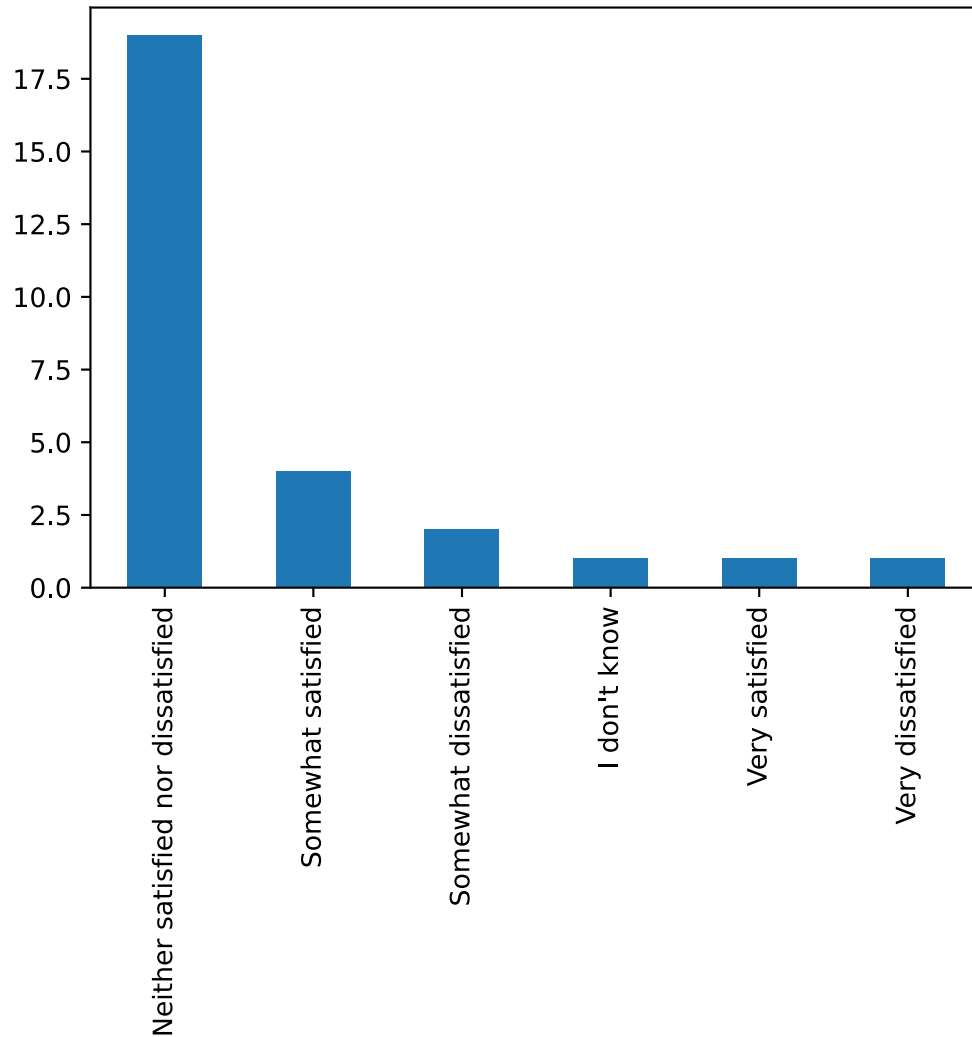
Mean 3.04

Standard deviation 0.9222

The average participant is neither satisfied nor dissatisfied with government regulations on automated technology

```
In [18]: dataframe["Question 21"].value_counts().plot.bar() # Below is bar graph from Q
          uestion 21
          # Very satisfied = 1, Somewhat satisfied = 2, Neither satisfied nor dissatisfi
          ed = 3, Somewhat dissatisfied = 4, Very dissatisfied = 5, I don't know = 6 (Us
          ed to determine mean and standard deviation)
```

```
Out[18]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8c96c1f0>
```



Participants were asked (Question 22) "Overall how trustworthy do you believe automated technologies are?" from a scale of 1-10, 1 being not at all trustworthy, 10 being very trustworthy

68% of participants overall found automated technologies to be untrustworthy, or very untrustworthy

18% of participants overall found automated technologies to be neutral, or somewhat trustworthy

14% of participants overall found automated technologies to be trustworthy, or very trustworthy

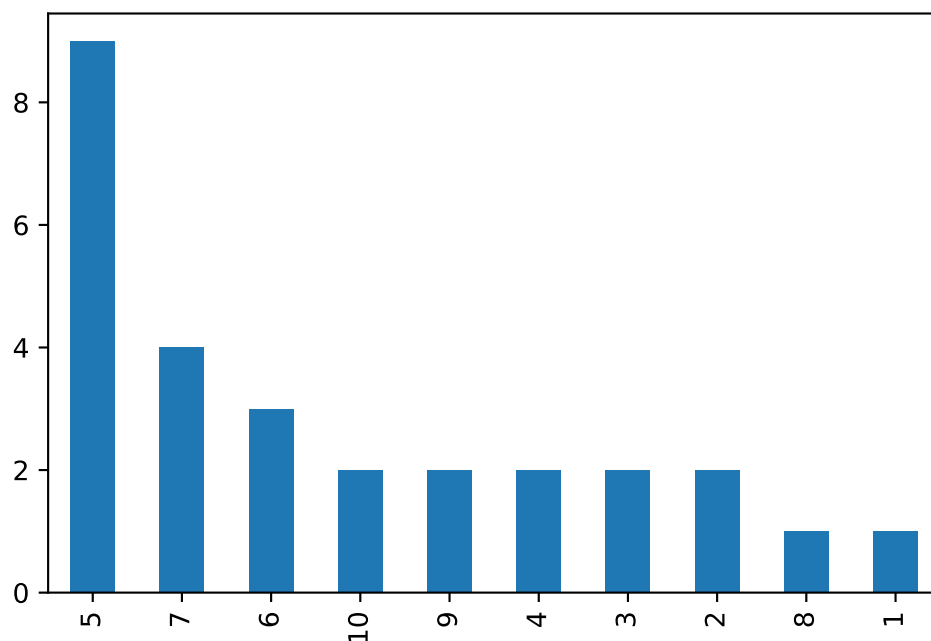
Mean 5.57

Standard deviation 2.3163

The average participant overall found automated technologies to be untrustworthy

```
In [19]: dataframe["Question 22"].value_counts().plot.bar() # Below is bar graph from Question 22
```

```
Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b8caa90>
```



Participants were asked (Question 23) "Overall how impactful do you believe automated technologies are to society?" from a scale of 1-10, 1 being not at all impactful, 10 being very impactful

36% of participants overall found automated technologies to be impactful, or very impactful to society

36% of participants overall found automated technologies to be neutral, or somewhat impactful to society

28% of participants overall found automated technologies to be not at all, or not very impactful to society

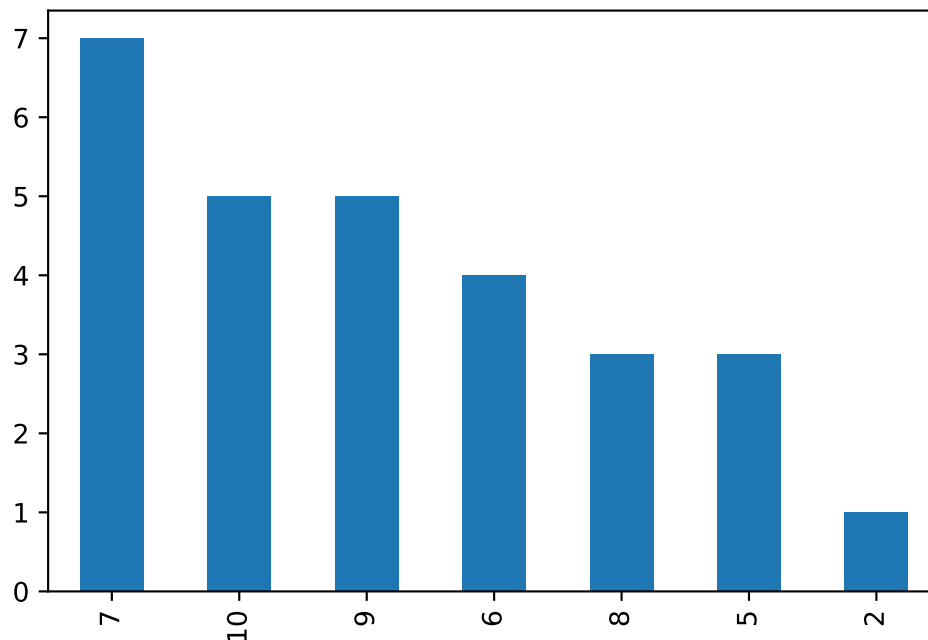
Mean 5.57

Standard deviation 2.3163

The average participant overall found automated technologies to be somewhat impactful to society

```
In [20]: dataframe["Question 23"].value_counts().plot.bar() # Below is bar graph from Question 23
```

```
Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8c9c9490>
```



Participants were asked (Question 24) " Overall how impactful do you believe automated technologies are to your life?" from a scale of 1-10, 1 being not at all impactful, 10 being very impactful

54% of participants overall found automated technologies to be impactful, or very impactful to their life

25% of participants overall found automated technologies to be neutral, or somewhat impactful to their life

21% of participants overall found automated technologies to be not at all, or not very impactful to their life

Mean 6.07

Standard deviation 2.9304

The average participant overall found automated technologies to be impactful to their life

```
In [21]: dataframe["Question 24"].value_counts().plot.bar() # Below is bar graph from Question 24
```

```
Out[21]: <matplotlib.axes._subplots.AxesSubplot at 0x1ca8b839bb0>
```

