Velikadu_Krishnamoorthy_530Week3

April 2, 2023

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1.1 Week 3 Assignment

1.2 Initial setup:

This section contains the initial download of the files and Python files that will be references in this assignment.

[1]:
```
# Download basename and exists from OS module which will be used in the␣
↪download function
from os.path import basename, exists

# Create a function named download_file, to download the scripts and files from␣
↪Github to local path
def download_file(url):
    """
    Downloads the scripts/ files from Github to local directory
    takes url as input.
    """
    filename = basename(url)
    # Checking if the file exists in the local directory and it downloads the␣
↪file if it doesn't exist already.
    if not exists(filename):
        from urllib.request import urlretrieve
        # Downloading the files to the local path
        local, _ = urlretrieve(url, filename)
        # Printing confirmation message
        print("Downloaded " + local)

#  Calling download functions to download thinkstats2.py and thinkplot.py used␣
↪throughtout this assignment
download_file("https://github.com/AllenDowney/ThinkStats2/raw/master/code/
↪thinkstats2.py")
download_file("https://github.com/AllenDowney/ThinkStats2/raw/master/code/
↪thinkplot.py")
```

[2]:
```
# Calling download_file function to download source files and nsfg.py
```

```
download_file("https://github.com/AllenDowney/ThinkStats2/raw/master/code/nsfg.
 ↪py")

download_file("https://github.com/AllenDowney/ThinkStats2/raw/master/code/
 ↪2002FemPreg.dct")
download_file(
    "https://github.com/AllenDowney/ThinkStats2/raw/master/code/2002FemPreg.dat.
 ↪gz"
)
```

[3]:
```
# Importing the nsfg and other modules module from the author's code
import nsfg
import thinkstats2
import thinkplot

# importing the required libraries
import numpy as np
import sys
from collections import defaultdict
import math
import itertools
import pandas as pd
```

[4]:
```
# Setting the maximum number of rows and columns to display
pd.options.display.max_rows=20
pd.options.display.max_columns=100
pd.options.display.precision =3
```

[5]:
```
# Creating a Pandas dataframe named pregnancy_df by reading the file␣
 ↪2002FemPreg.dat.gz
# and definition file 2002FemPreg.dct

dct_file='2002FemPreg.dct'
dat_file='2002FemPreg.dat.gz'

# reading the contents of dictionary file
dictionary_file = thinkstats2.ReadStataDct(dct_file)
# creating a dataframe pregnancy_df by reading contents of source file
pregnancy_df = dictionary_file.ReadFixedWidth(dat_file, compression='gzip')
# Calling the CleanFemPreg to cleanse the dataframe
nsfg.CleanFemPreg(pregnancy_df)
# Printing the top 5 lines of dataframe
pregnancy_df.head()
```

[5]:
```
   caseid  pregordr  howpreg_n  howpreg_p  moscurrp  nowprgdk  pregend1  \
0       1         1        NaN        NaN       NaN       NaN       6.0
1       1         2        NaN        NaN       NaN       NaN       6.0
```

```
2       2       1      NaN       NaN      NaN      NaN      5.0
3       2       2      NaN       NaN      NaN      NaN      6.0
4       2       3      NaN       NaN      NaN      NaN      6.0

   pregend2  nbrnaliv  multbrth  cmotpreg  prgoutcome  cmprgend  flgdkmo1  \
0       NaN       1.0       NaN       NaN         1.0    1093.0       NaN
1       NaN       1.0       NaN       NaN         1.0    1166.0       NaN
2       NaN       3.0       5.0       NaN         1.0    1156.0       NaN
3       NaN       1.0       NaN       NaN         1.0    1198.0       NaN
4       NaN       1.0       NaN       NaN         1.0    1204.0       NaN

   cmprgbeg  ageatend  hpageend  gestasun_m  gestasun_w  wksgest  mosgest  \
0    1084.0       NaN       NaN         9.0         0.0     39.0      9.0
1    1157.0       NaN       NaN         9.0         0.0     39.0      9.0
2    1147.0       NaN       NaN         0.0        39.0     39.0      9.0
3    1189.0       NaN       NaN         0.0        39.0     39.0      9.0
4    1195.0       NaN       NaN         0.0        39.0     39.0      9.0

   dk1gest  dk2gest  dk3gest  bpa_bdscheck1  bpa_bdscheck2  bpa_bdscheck3  \
0      NaN      NaN      NaN            0.0            NaN            NaN
1      NaN      NaN      NaN            0.0            NaN            NaN
2      NaN      NaN      NaN            0.0            NaN            NaN
3      NaN      NaN      NaN            0.0            NaN            NaN
4      NaN      NaN      NaN            0.0            NaN            NaN

   babysex  birthwgt_lb  birthwgt_oz  lobthwgt  babysex2  birthwgt_lb2  \
0      1.0          8.0         13.0       NaN       NaN           NaN
1      2.0          7.0         14.0       NaN       NaN           NaN
2      1.0          9.0          2.0       NaN       2.0           2.0
3      2.0          7.0          0.0       NaN       NaN           NaN
4      2.0          6.0          3.0       NaN       NaN           NaN

   birthwgt_oz2  lobthwgt2  babysex3  birthwgt_lb3  birthwgt_oz3  lobthwgt3  \
0           NaN        NaN       NaN           NaN           NaN        NaN
1           NaN        NaN       NaN           NaN           NaN        NaN
2           0.0        NaN       1.0           1.0           4.0        NaN
3           NaN        NaN       NaN           NaN           NaN        NaN
4           NaN        NaN       NaN           NaN           NaN        NaN

   cmbabdob  kidage  hpagelb  birthplc  paybirth1  paybirth2  paybirth3  \
0    1093.0   138.0     37.0       NaN        NaN        NaN        NaN
1    1166.0    65.0     42.0       1.0        1.0        2.0        NaN
2    1156.0    75.0     24.0       NaN        NaN        NaN        NaN
3    1198.0    33.0     25.0       1.0        3.0        NaN        NaN
4    1204.0    27.0     25.0       1.0        3.0        NaN        NaN

   knewpreg  trimestr  ltrimest  priorsmk  …  laborfor  religion  metro  \
```

```
0        NaN        NaN        NaN        NaN  ...          3          2       1
1        2.0        NaN        NaN        0.0  ...          3          2       1
2        NaN        NaN        NaN        NaN  ...          2          3       1
3        3.0        NaN        NaN        0.0  ...          2          3       1
4        2.0        NaN        NaN        0.0  ...          2          3       1

   brnout  yrstrus  prglngth_i  outcome_i  birthord_i  datend_i  agepreg_i  \
0       5      NaN           0          0           0         0          0
1       5      NaN           0          0           0         0          0
2       5      NaN           0          0           0         0          0
3       5      NaN           0          0           0         0          0
4       5      NaN           0          0           0         0          0

   datecon_i  agecon_i  fmarout5_i  pmarpreg_i  rmarout6_i  fmarcon5_i  \
0          0         0           0           0           0           0
1          0         0           0           0           0           0
2          0         0           0           0           0           0
3          0         0           0           0           0           0
4          0         0           0           0           0           0

   learnprg_i  pncarewk_i  paydeliv_i  lbw1_i  bfeedwks_i  maternlv_i  \
0           0           0           0       0           0           0
1           0           0           0       0           0           0
2           0           0           0       0           0           0
3           0           0           0       0           0           0
4           0           0           0       0           0           0

   oldwantr_i  oldwantp_i  wantresp_i  wantpart_i  ager_i  fmarital_i  \
0           0           0           0           0       0           0
1           0           0           0           0       0           0
2           0           0           0           0       0           0
3           0           0           0           0       0           0
4           0           0           0           0       0           0

   rmarital_i  educat_i  hieduc_i  race_i  hispanic_i  hisprace_i  rcurpreg_i  \
0           0         0         0       0           0           0           0
1           0         0         0       0           0           0           0
2           0         0         0       0           0           0           0
3           0         0         0       0           0           0           0
4           0         0         0       0           0           0           0

   pregnum_i  parity_i  insuranc_i  pubassis_i  poverty_i  laborfor_i  \
0          0         0           0           0          0           0
1          0         0           0           0          0           0
2          0         0           0           0          0           0
3          0         0           0           0          0           0
4          0         0           0           0          0           0
```

```
   religion_i  metro_i   basewgt  adj_mod_basewgt   finalwgt  secu_p  sest  \
0           0        0  3410.389         3869.350   6448.271       2     9
1           0        0  3410.389         3869.350   6448.271       2     9
2           0        0  7226.302         8567.549  12999.542       2    12
3           0        0  7226.302         8567.549  12999.542       2    12
4           0        0  7226.302         8567.549  12999.542       2    12

   cmintvw  totalwgt_lb
0      NaN        8.812
1      NaN        7.875
2      NaN        9.125
3      NaN        7.000
4      NaN        6.188

[5 rows x 244 columns]
```

[6]:

```python
# Printing the row and column size of the Pregnancy dataframe
print(pregnancy_df.shape)

# Validating the contents of Dataframe. If all tests are a pass, no results␣
↪will be returned, else assertion error will be raised.
assert len(pregnancy_df) == 13593
assert pregnancy_df.caseid[13592] == 12571
assert pregnancy_df.pregordr.value_counts()[1] == 5033
assert pregnancy_df.nbrnaliv.value_counts()[1] == 8981
assert pregnancy_df.babysex.value_counts()[1] == 4641
assert pregnancy_df.birthwgt_lb.value_counts()[7] == 3049
assert pregnancy_df.birthwgt_oz.value_counts()[0] == 1037
assert pregnancy_df.prglngth.value_counts()[39] == 4744
assert pregnancy_df.outcome.value_counts()[1] == 9148
assert pregnancy_df.birthord.value_counts()[1] == 4413
assert pregnancy_df.agepreg.value_counts()[22.75] == 100
assert pregnancy_df.totalwgt_lb.value_counts()[7.5] == 302

weights = pregnancy_df.finalwgt.value_counts()
key = max(weights.keys())
assert pregnancy_df.finalwgt.value_counts()[key] == 6
```

```
(13593, 244)
```

2 Exercise 1.1

Select the birthord column, print the value counts, and compare to results published in the codebook

[7]:

```
# Validating the output with NFSG Codebook located at : https://ftp.cdc.gov/pub/
↪Health_Statistics/NCHS/Dataset_Documentation/NSFG/Cycle6Codebook-Pregnancy.
↪pdf
pregnancy_df.birthord.value_counts().sort_index()
```

[7]:
```
1.0     4413
2.0     2874
3.0     1234
4.0      421
5.0      126
6.0       50
7.0       20
8.0        7
9.0        2
10.0       1
Name: birthord, dtype: int64
```

We can also use isnull to count the number of nans.

[8]:
```
# Using isnull function to calculate the total number of nulls
pregnancy_df.birthord.isnull().sum()
```

[8]:
```
4445
```

Select the prglngth column, print the value counts, and compare to results published in the [codebook]

[9]:
```
# Validating the output with NFSG Codebook located at : https://ftp.cdc.gov/pub/
↪Health_Statistics/NCHS/Dataset_Documentation/NSFG/Cycle6Codebook-Pregnancy.
↪pdf
pregnancy_df.prglngth.value_counts().sort_index()
```

[9]:
```
0      15
1       9
2      78
3     151
4     412
     …
45     10
46      1
47      1
48      7
50      2
Name: prglngth, Length: 50, dtype: int64
```

To compute the mean of a column, you can invoke the mean method on a Series. For example, here is the mean birthweight in pounds:

[10]:
```
# Calculating mean of totalwgt_lb column
pregnancy_df.totalwgt_lb.mean()
```

[10]: 7.265628457623368

Create a new column named totalwgt_kg that contains birth weight in kilograms. Compute its mean. Remember that when you create a new column, you have to use dictionary syntax, not dot notation.

[11]:
```
# Converting the Total weight in pounds to Kilogram by dividing by 2.2
pregnancy_df["totalwgt_kg"]=pregnancy_df["totalwgt_lb"]/2.20
# calculating mean of Kilogram using mean method
totalwgt_kg_mean=pregnancy_df.totalwgt_kg.mean()
print(f"The Mean weight in Kilogram is {totalwgt_kg_mean}")
```

```
The Mean weight in Kilogram is 3.302558389828807
```

nsfg.py also provides ReadFemResp, which reads the female respondents file and returns a DataFrame:

[12]:
```
# Downloading the file 2002FemResp.dat.gz and its structure from Github
# using download_file function
download_file("https://github.com/AllenDowney/ThinkStats2/raw/master/code/
↪2002FemResp.dct")
download_file("https://github.com/AllenDowney/ThinkStats2/raw/master/code/
↪2002FemResp.dat.gz")
```

[13]:
```
# Creating a new dataframe to store the Female Respondents file
dct_file_resp='2002FemResp.dct'
dat_file_resp='2002FemResp.dat.gz'

# creating a dictioary to read the contents and creating the dataframe from its␣
↪definition.
dictionary_resp = thinkstats2.ReadStataDct(dct_file_resp)
respondents_df = dictionary_resp.ReadFixedWidth(dat_file_resp,␣
↪compression='gzip')
# Validating the dataframe results
assert(len(respondents_df) == 7643)
assert(respondents_df.pregnum.value_counts()[1] == 1267)
```

DataFrame provides a method head that displays the first five rows:

[14]:
```
respondents_df.head()
```

[14]:
```
   caseid  rscrinf  rdormres  rostscrn  rscreenhisp  rscreenrace  age_a  \
0    2298        1         5         5            1          5.0     27
1    5012        1         5         1            5          5.0     42
2   11586        1         5         1            5          5.0     43
3    6794        5         5         4            1          5.0     15
4     616        1         5         4            1          5.0     20

   age_r  cmbirth  agescrn  marstat  fmarstat  fmarit  evrmarry  hisp  \
0     27      902       27        2       6.0       5         0     1
```

```
1     42      718       42         1       NaN       1          1     5
2     43      708       43         4       NaN       3          1     5
3     15     1042       15         6       NaN       5          0     1
4     20      991       20         6       NaN       5          0     1

   hispgrp  numrace  roscnt  hplocale  manrel  fl_rage  fl_rrace  fl_rhisp  \
0      1.0        1       5       1.0     2.0        0         0         0
1      NaN        1       2       1.0     1.0        0         0         0
2      NaN        1       1       NaN     NaN        0         0         0
3      2.0        1       4       NaN     NaN        0         0         0
4      1.0        1       4       NaN     NaN        0         0         0

   goschol  vaca  higrade  compgrd  havedip  dipged  cmhsgrad  havedeg  \
0        5   NaN       10      1.0      5.0     NaN       NaN      NaN
1        5   NaN       14      5.0      1.0     2.0       NaN      5.0
2        5   NaN       12      1.0      1.0     1.0     932.0      NaN
3        1   5.0       10      5.0      NaN     NaN       NaN      NaN
4        1   5.0       11      5.0      NaN     NaN       NaN      NaN

   degrees  wthparnw  onown  intact  parmarr  lvsit14f  lvsit14m  womrasdu  \
0      NaN         2    5.0     1.0        1       NaN       NaN       NaN
1      NaN         2    5.0     1.0        1       NaN       NaN       NaN
2      NaN         2    5.0     1.0        1       NaN       NaN       NaN
3      NaN         1    5.0     5.0        1       1.0       1.0       1.0
4      NaN         2    1.0     1.0        1       NaN       NaN       NaN

   momdegre  momworkd  momchild  momfstch  mom18  manrasdu  daddegre  \
0       1.0       1.0       6.0       2.0    NaN       NaN       1.0
1       1.0       2.0       5.0       4.0    NaN       NaN       2.0
2       1.0       4.0       1.0       4.0    NaN       NaN       2.0
3       2.0       4.0       2.0       3.0    NaN       1.0       2.0
4       2.0       1.0       3.0       3.0    NaN       NaN       1.0

   bothbiol  intact18  onown18  numbabes  …  anymschp  infever  ovulate  \
0         0         1        5         4  …       2.0      2.0      NaN
1         0         1        5         1  …       2.0      2.0      NaN
2         0         1        5         1  …       2.0      2.0      NaN
3         1         5        5         0  …       2.0      2.0      NaN
4         0         1        1         0  …       2.0      2.0      NaN

   tubes  infertr  inferth  advice  insem  invitro  endomet  fibroids  \
0    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
1    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
2    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
3    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
4    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
```

```
   pidtreat  evhivtst  anyprghp_i  anymschp_i  infever_i  ovulate_i  tubes_i  \
0         2         0           0           0          0          0        0
1         2         2           0           0          0          0        0
2         2         2           0           0          0          0        0
3         2         0           0           0          0          0        0
4         1         1           0           0          0          0        0

   infertr_i  inferth_i  advice_i  insem_i  invitro_i  endomet_i  fibroids_i  \
0          0          0         0        0          0          0           0
1          0          0         0        0          0          0           0
2          0          0         0        0          0          0           0
3          0          0         0        0          0          0           0
4          0          0         0        0          0          0           0

   pidtreat_i  evhivtst_i  insuranc  metro  religion  laborfor  insuranc_i  \
0           0           0         1      1         2         7           0
1           0           0         4      1         1         1           0
2           0           0         4      1         1         9           0
3           0           0         2      1         1         6           0
4           0           0         2      1         3         6           0

   metro_i  religion_i  laborfor_i  poverty  totincr  pubassis  poverty_i  \
0        0           0           0      156        9         2          0
1        0           0           0      334       10         2          0
2        0           0           0      156        5         2          0
3        0           0           0      383       13         2          0
4        0           0           0       99        6         2          0

   totincr_i  pubassis_i   basewgt  adj_mod_basewgt  finalwgt  secu_r  sest  \
0          0           0  3247.917         5123.760  5556.717       2    18
1          0           0  2335.279         2846.799  4744.191       2    18
2          0           0  2335.279         2846.799  4744.191       2    18
3          0           0  3783.152         5071.464  5923.977       2    18
4          0           0  5341.330         6437.336  7229.128       2    18

   cmintvw  cmlstyr  screentime  intvlngth
0     1234     1222    18:26:36    110.493
1     1233     1221    16:30:59     64.294
2     1234     1222    18:19:09     75.149
3     1234     1222    15:54:43     28.643
4     1233     1221    14:19:44     69.503

[5 rows x 3087 columns]
```

Select the age_r column from resp and print the value counts. How old are the youngest and oldest respondents?

[15]:
```
# Printing the count of different ages in respondents_df
respondents_df.age_r.value_counts().sort_index()
```

[15]:
```
15    217
16    223
17    234
18    235
19    241
     …
40    256
41    250
42    215
43    253
44    235
Name: age_r, Length: 30, dtype: int64
```

[16]:
```
# Printing youngest and oldest respondent's age
print(f"The Youngest respondents are of age {respondents_df.age_r.min()} and␣
 ↪oldest are of {respondents_df.age_r.max()} years old.")
```

```
The Youngest respondents are of age 15 and oldest are of 44 years old.
```

We can use the caseid to match up rows from resp and preg. For example, we can select the row from resp for caseid 2298 like this:

[17]:
```
respondents_df[respondents_df.caseid==2298]
```

[17]:
```
   caseid  rscrinf  rdormres  rostscrn  rscreenhisp  rscreenrace  age_a  \
0    2298        1         5         5            1          5.0     27

   age_r  cmbirth  agescrn  marstat  fmarstat  fmarit  evrmarry  hisp  \
0     27      902       27        2       6.0       5         0     1

   hispgrp  numrace  roscnt  hplocale  manrel  fl_rage  fl_rrace  fl_rhisp  \
0      1.0        1       5       1.0     2.0        0         0         0

   goschol  vaca  higrade  compgrd  havedip  dipged  cmhsgrad  havedeg  \
0        5   NaN       10      1.0      5.0     NaN       NaN      NaN

   degrees  wthparnw  onown  intact  parmarr  lvsit14f  lvsit14m  womrasdu  \
0      NaN         2    5.0     1.0        1       NaN       NaN       NaN

   momdegre  momworkd  momchild  momfstch  mom18  manrasdu  daddegre  \
0       1.0       1.0       6.0       2.0    NaN       NaN       1.0

   bothbiol  intact18  onown18  numbabes  …  anymschp  infever  ovulate  \
0         0         1        5         4  …       2.0      2.0      NaN

   tubes  infertr  inferth  advice  insem  invitro  endomet  fibroids  \
```

```
0    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN

   pidtreat  evhivtst  anyprghp_i  anymschp_i  infever_i  ovulate_i  tubes_i  \
0         2         0           0           0          0          0        0

   infertr_i  inferth_i  advice_i  insem_i  invitro_i  endomet_i  fibroids_i  \
0          0          0         0        0          0          0           0

   pidtreat_i  evhivtst_i  insuranc  metro  religion  laborfor  insuranc_i  \
0           0           0         1      1         2         7           0

   metro_i  religion_i  laborfor_i  poverty  totincr  pubassis  poverty_i  \
0        0           0           0      156        9         2          0

   totincr_i  pubassis_i   basewgt  adj_mod_basewgt  finalwgt  secu_r  sest  \
0          0           0  3247.917          5123.76  5556.717       2    18

   cmintvw  cmlstyr  screentime  intvlngth
0     1234     1222    18:26:36    110.493

[1 rows x 3087 columns]
```

And we can get the corresponding rows from preg like this:

[18]:
```python
pregnancy_df[pregnancy_df.caseid==2298]
```

[18]:
```
      caseid  pregordr  howpreg_n  howpreg_p  moscurrp  nowprgdk  pregend1  \
2610    2298         1        NaN        NaN       NaN       NaN       6.0
2611    2298         2        NaN        NaN       NaN       NaN       6.0
2612    2298         3        NaN        NaN       NaN       NaN       6.0
2613    2298         4        NaN        NaN       NaN       NaN       6.0

      pregend2  nbrnaliv  multbrth  cmotpreg  prgoutcome  cmprgend  flgdkmo1  \
2610       NaN       1.0       NaN       NaN         1.0    1119.0       NaN
2611       NaN       1.0       NaN       NaN         1.0    1142.0       NaN
2612       NaN       1.0       NaN       NaN         1.0    1159.0       NaN
2613       NaN       1.0       NaN       NaN         1.0    1198.0       NaN

      cmprgbeg  ageatend  hpageend  gestasun_m  gestasun_w  wksgest  mosgest  \
2610    1110.0       NaN       NaN         0.0        40.0     40.0      9.0
2611    1134.0       NaN       NaN         0.0        36.0     36.0      8.0
2612    1152.0       NaN       NaN         0.0        30.0     30.0      7.0
2613    1189.0       NaN       NaN         0.0        40.0     40.0      9.0

      dk1gest  dk2gest  dk3gest  bpa_bdscheck1  bpa_bdscheck2  bpa_bdscheck3  \
2610      NaN      NaN      NaN            0.0            NaN            NaN
2611      NaN      NaN      NaN            0.0            NaN            NaN
2612      NaN      NaN      NaN            0.0            NaN            NaN
```

```
2613      NaN      NaN      NaN            0.0            NaN            NaN

     babysex  birthwgt_lb  birthwgt_oz  lobthwgt  babysex2  birthwgt_lb2  \
2610     2.0          6.0         14.0       NaN       NaN           NaN
2611     1.0          5.0          8.0       NaN       NaN           NaN
2612     2.0          4.0          3.0       NaN       NaN           NaN
2613     1.0          6.0         14.0       NaN       NaN           NaN

     birthwgt_oz2  lobthwgt2  babysex3  birthwgt_lb3  birthwgt_oz3  \
2610          NaN        NaN       NaN           NaN           NaN
2611          NaN        NaN       NaN           NaN           NaN
2612          NaN        NaN       NaN           NaN           NaN
2613          NaN        NaN       NaN           NaN           NaN

     lobthwgt3  cmbabdob  kidage  hpagelb  birthplc  paybirth1  paybirth2  \
2610       NaN    1119.0   115.0     24.0       NaN        NaN        NaN
2611       NaN    1142.0    92.0     27.0       NaN        NaN        NaN
2612       NaN    1159.0    75.0     28.0       NaN        NaN        NaN
2613       NaN    1198.0    36.0     30.0       1.0        3.0        NaN

     paybirth3  knewpreg  trimestr  ltrimest  priorsmk  …  religion  metro  \
2610       NaN       NaN       NaN       NaN       NaN  …         2      1
2611       NaN       NaN       NaN       NaN       NaN  …         2      1
2612       NaN       NaN       NaN       NaN       NaN  …         2      1
2613       NaN       3.0       NaN       NaN       0.0  …         2      1

     brnout  yrstrus  prglngth_i  outcome_i  birthord_i  datend_i  agepreg_i  \
2610      1   1985.0           0          0           0         0          0
2611      1   1985.0           0          0           0         0          0
2612      1   1985.0           0          0           0         0          0
2613      1   1985.0           0          0           0         0          0

     datecon_i  agecon_i  fmarout5_i  pmarpreg_i  rmarout6_i  fmarcon5_i  \
2610         0         0           0           0           0           0
2611         0         0           0           0           0           0
2612         0         0           0           0           0           0
2613         0         0           0           0           0           0

     learnprg_i  pncarewk_i  paydeliv_i  lbw1_i  bfeedwks_i  maternlv_i  \
2610          0           0           0       0           0           0
2611          0           0           0       0           0           0
2612          0           0           0       0           0           0
2613          0           0           0       0           0           0

     oldwantr_i  oldwantp_i  wantresp_i  wantpart_i  ager_i  fmarital_i  \
2610          0           0           0           0       0           0
2611          0           0           0           0       0           0
```

```
2612           0           0           0          0      0           0
2613           0           0           0          0      0           0

      rmarital_i  educat_i  hieduc_i  race_i  hispanic_i  hisprace_i  \
2610           0         0         0       0           0           0
2611           0         0         0       0           0           0
2612           0         0         0       0           0           0
2613           0         0         0       0           0           0

      rcurpreg_i  pregnum_i  parity_i  insuranc_i  pubassis_i  poverty_i  \
2610           0          0         0           0           0          0
2611           0          0         0           0           0          0
2612           0          0         0           0           0          0
2613           0          0         0           0           0          0

      laborfor_i  religion_i  metro_i   basewgt  adj_mod_basewgt  finalwgt  \
2610           0           0        0  3247.917          5123.76  5556.717
2611           0           0        0  3247.917          5123.76  5556.717
2612           0           0        0  3247.917          5123.76  5556.717
2613           0           0        0  3247.917          5123.76  5556.717

      secu_p  sest  cmintvw  totalwgt_lb  totalwgt_kg
2610       2    18      NaN        6.875        3.125
2611       2    18      NaN        5.500        2.500
2612       2    18      NaN        4.188        1.903
2613       2    18      NaN        6.875        3.125

[4 rows x 245 columns]
```

How old is the respondent with caseid 1?

[19]:
```python
respondents_df[respondents_df.caseid==1].age_r
```

[19]:
```
1069    44
Name: age_r, dtype: int64
```

What are the pregnancy lengths for the respondent with caseid 2298?

[20]:
```python
pregnancy_df[pregnancy_df.caseid==2298].prglngth
```

[20]:
```
2610    40
2611    36
2612    30
2613    40
Name: prglngth, dtype: int64
```

What was the birthweight of the first baby born to the respondent with caseid 5012?

[21]:
```python
pregnancy_df[pregnancy_df.caseid==5012].birthwgt_lb
```

[21]:
```
5515    6.0
Name: birthwgt_lb, dtype: float64
```

3 Exercise 1-2

[22]:
```
# Using the 2002FemResp.data.gz that was used as part of exercise 1.1.
respondents_df.head()
```

[22]:
```
   caseid  rscrinf  rdormres  rostscrn  rscreenhisp  rscreenrace  age_a  \
0    2298        1         5         5            1          5.0     27
1    5012        1         5         1            5          5.0     42
2   11586        1         5         1            5          5.0     43
3    6794        5         5         4            1          5.0     15
4     616        1         5         4            1          5.0     20

   age_r  cmbirth  agescrn  marstat  fmarstat  fmarit  evrmarry  hisp  \
0     27      902       27        2       6.0       5         0     1
1     42      718       42        1       NaN       1         1     5
2     43      708       43        4       NaN       3         1     5
3     15     1042       15        6       NaN       5         0     1
4     20      991       20        6       NaN       5         0     1

   hispgrp  numrace  roscnt  hplocale  manrel  fl_rage  fl_rrace  fl_rhisp  \
0      1.0        1       5       1.0     2.0        0         0         0
1      NaN        1       2       1.0     1.0        0         0         0
2      NaN        1       1       NaN     NaN        0         0         0
3      2.0        1       4       NaN     NaN        0         0         0
4      1.0        1       4       NaN     NaN        0         0         0

   goschol  vaca  higrade  compgrd  havedip  dipged  cmhsgrad  havedeg  \
0        5   NaN       10      1.0      5.0     NaN       NaN      NaN
1        5   NaN       14      5.0      1.0     2.0       NaN      5.0
2        5   NaN       12      1.0      1.0     1.0     932.0      NaN
3        1   5.0       10      5.0      NaN     NaN       NaN      NaN
4        1   5.0       11      5.0      NaN     NaN       NaN      NaN

   degrees  wthparnw  onown  intact  parmarr  lvsit14f  lvsit14m  womrasdu  \
0      NaN         2    5.0     1.0        1       NaN       NaN       NaN
1      NaN         2    5.0     1.0        1       NaN       NaN       NaN
2      NaN         2    5.0     1.0        1       NaN       NaN       NaN
3      NaN         1    5.0     5.0        1       1.0       1.0       1.0
4      NaN         2    1.0     1.0        1       NaN       NaN       NaN

   momdegre  momworkd  momchild  momfstch  mom18  manrasdu  daddegre  \
0       1.0       1.0       6.0       2.0    NaN       NaN       1.0
1       1.0       2.0       5.0       4.0    NaN       NaN       2.0
2       1.0       4.0       1.0       4.0    NaN       NaN       2.0
```

```
3       2.0       4.0       2.0       3.0    NaN       1.0       2.0
4       2.0       1.0       3.0       3.0    NaN       NaN       1.0

   bothbiol  intact18  onown18  numbabes  …  anymschp  infever  ovulate  \
0         0         1        5         4  …       2.0      2.0      NaN
1         0         1        5         1  …       2.0      2.0      NaN
2         0         1        5         1  …       2.0      2.0      NaN
3         1         5        5         0  …       2.0      2.0      NaN
4         0         1        1         0  …       2.0      2.0      NaN

   tubes  infertr  inferth  advice  insem  invitro  endomet  fibroids  \
0    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
1    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
2    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
3    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN
4    NaN      NaN      NaN     NaN    NaN      NaN      NaN       NaN

   pidtreat  evhivtst  anyprghp_i  anymschp_i  infever_i  ovulate_i  tubes_i  \
0         2         0           0           0          0          0        0
1         2         2           0           0          0          0        0
2         2         2           0           0          0          0        0
3         2         0           0           0          0          0        0
4         1         1           0           0          0          0        0

   infertr_i  inferth_i  advice_i  insem_i  invitro_i  endomet_i  fibroids_i  \
0          0          0         0        0          0          0           0
1          0          0         0        0          0          0           0
2          0          0         0        0          0          0           0
3          0          0         0        0          0          0           0
4          0          0         0        0          0          0           0

   pidtreat_i  evhivtst_i  insuranc  metro  religion  laborfor  insuranc_i  \
0           0           0         1      1         2         7           0
1           0           0         4      1         1         1           0
2           0           0         4      1         1         9           0
3           0           0         2      1         1         6           0
4           0           0         2      1         3         6           0

   metro_i  religion_i  laborfor_i  poverty  totincr  pubassis  poverty_i  \
0        0           0           0      156        9         2          0
1        0           0           0      334       10         2          0
2        0           0           0      156        5         2          0
3        0           0           0      383       13         2          0
4        0           0           0       99        6         2          0

   totincr_i  pubassis_i   basewgt  adj_mod_basewgt  finalwgt  secu_r  sest  \
0          0           0  3247.917         5123.760  5556.717       2    18
```

```
1          0            0  2335.279         2846.799  4744.191        2    18
2          0            0  2335.279         2846.799  4744.191        2    18
3          0            0  3783.152         5071.464  5923.977        2    18
4          0            0  5341.330         6437.336  7229.128        2    18

   cmintvw  cmlstyr  screentime  intvlngth
0     1234     1222    18:26:36    110.493
1     1233     1221    16:30:59     64.294
2     1234     1222    18:19:09     75.149
3     1234     1222    15:54:43     28.643
4     1233     1221    14:19:44     69.503

[5 rows x 3087 columns]
```

The variable pregnum is a recode that represents how many times each respondent has been pregnant. Print the value counts for this variable and compare them to the published results in NFSG codebook.

[23]:
```python
# Validating the results in https://ftp.cdc.gov/pub/Health_Statistics/NCHS/
↪Dataset_Documentation/NSFG/Cycle6Codebook-Female.pdf
respondents_df.pregnum.value_counts().sort_index()
```

[23]:
```
0     2610
1     1267
2     1432
3     1110
4      611
5      305
6      150
7       80
8       40
9       21
10       9
11       3
12       2
14       2
19       1
Name: pregnum, dtype: int64
```

You can also cross validate the respondent and pregnancy files by comparing the pregnum for each respondent with the number of records in pregnancy file.

[24]:
```python
# creating a pregnancy Map for Pregnancy Dataframe using defaultdict function␣
↪with list argument from collections module
pregnancy_dict = defaultdict(list)

# Iterating through each item in caseid and appending to dictionary map
for preg_rowNum, preg_caseid in pregnancy_df.caseid.items():
```

```
    pregnancy_dict[preg_caseid].append(preg_rowNum)

    # Using itertools to print sample output from pregnancy_dict
pregnancy_dict_sample = dict(itertools.islice(pregnancy_dict.items(), 10))
print(pregnancy_dict_sample)
```

```
{1: [0, 1], 2: [2, 3, 4], 6: [5, 6, 7], 7: [8, 9], 12: [10], 14: [11, 12, 13],
15: [14, 15, 16], 18: [17, 18], 21: [19, 20], 23: [21, 22]}
```

creating a Map for Female Respondents and validating the number of pregnancies (pregnum) for each respondent with number of records in pregnancy files

[25]:
```
# creating a variable pregum_Valid_Ind to calculate the number of valid records
pregum_Valid_Ind=0
# Iterating through each value in respondents_df.pregnum and extracting index␣
↪and values
for resp_rowNum, pregnum in respondents_df.pregnum.items():
        # for each index, extract the respective caseid from respondent␣
↪dataframe
        resp_caseid = respondents_df.caseid[resp_rowNum]
        # for the caseid from respondents df, get all indexes that was␣
↪calculated in pregnancy dictionary map
        resp_caseid_indices = pregnancy_dict[resp_caseid]

        # If the number of pregnancies for a given caseid in
        # Pregnancy map does not match with the number of pregnancy in␣
↪respondents df, print the mistmatched results
        if len(resp_caseid_indices) != pregnum:
            print(resp_caseid, len(resp_caseid_indices), pregnum)

        # Using indicator to extract all valid values and increment by 1 to␣
↪keep track of the count
        else:
            pregum_Valid_Ind+=1
```

[26]:
```
print(f" The number of valid values are {pregum_Valid_Ind} ")
# Validating the count of valid values with number of rows in dataframe
# to make sure all the values are valid.
assert pregum_Valid_Ind == len(respondents_df)
```

```
 The number of valid values are 7643
```

4 Exercise 2.1

Summarize what you have learned about whether first babies arrive late?

[27]:
```
# Creating dataframes for Alive births based on condition that outcome of␣
↪Pregnancy df equals 1
```

```
live_births = pregnancy_df[pregnancy_df.outcome == 1]
# Creating Dataframes for First babies and other babies based on the BirthOrder
first_babies = live_births[live_births.birthord == 1]
other_babies = live_births[live_births.birthord != 1]
```

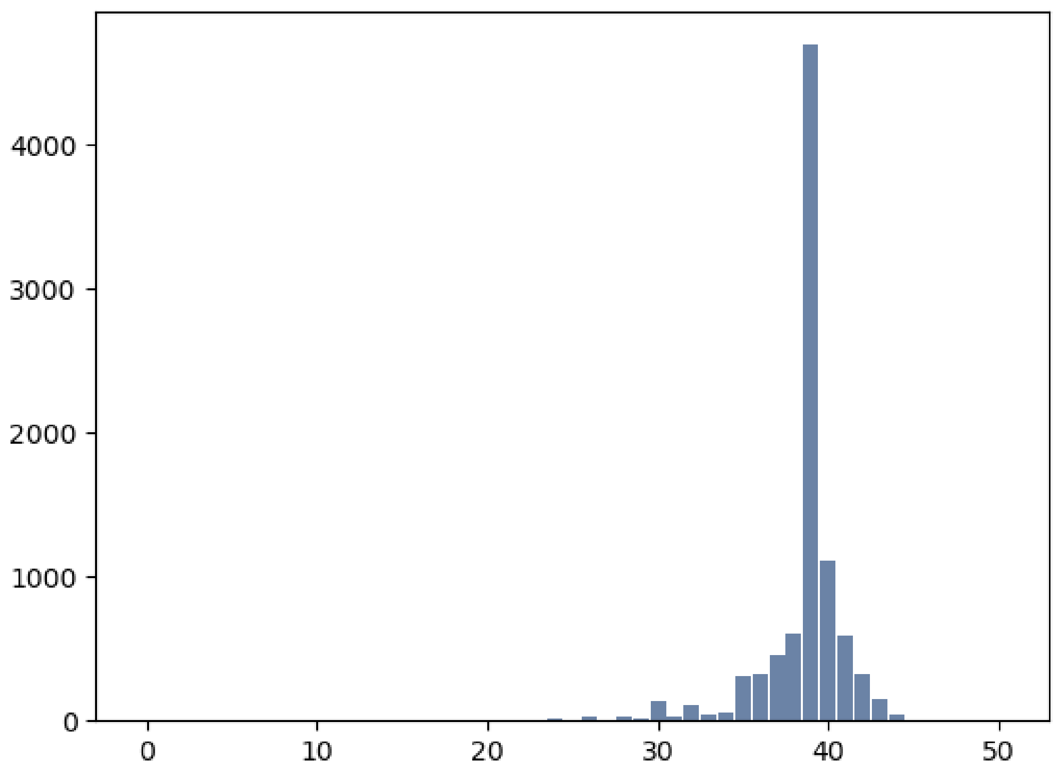
[28]:
```
# Calculating the Mean, Variance and Standard deviation of Live, first and␣
 ↪other births

# Summary statistics of Live births
mean_live = live_births.prglngth.mean()
var_live = live_births.prglngth.var()
std_live = live_births.prglngth.std()

# Summary statistics of  First babies
mean_first = first_babies.prglngth.mean()
var_first = first_babies.prglngth.var()
std_first = first_babies.prglngth.std()

# Summary statistics of  Other babies
mean_others = other_babies.prglngth.mean()
var_others = other_babies.prglngth.var()
std_others = other_babies.prglngth.std()

# Printing results of  Summary statistics
print(f'Mean of Live child births is {mean_live}')
print(f'Mean of First Child births is {mean_first}')
print(f'Mean of Other Child births is {mean_others}')

print("#############################################")

print(f'Variance of Live child births is {var_live}')
print(f'Variance of First Child births is {var_first}')
print(f'Variance of Other Child births is {var_others}')

print("#############################################")

print(f'Standard Deviation of Live child births is {std_live}')
print(f'Standard Deviation of First Child births is {std_first}')
print(f'Standard Deviation of Other Child births is {std_others}')

# Calculating Cohen's d between the groups First babies and Other Babies
mean_difference = mean_first-mean_others
# Calculating the number of items in the Dataframes of First Babies and Other␣
 ↪babies
len_first, len_others= len(first_babies) , len(other_babies)
# Calculating Pooled Vriance
```

```
pooled_var=((len_first * var_first) + (len_others * var_others))/ (len_first +
 ↪len_others)
# Calculating the Cohen's d from the variables defined above
cohens_d=mean_difference /math.sqrt(pooled_var)
print(f"Cohen's d Measure of First birth and Other child birth  Pregnancy
 ↪length is {cohens_d}")
```

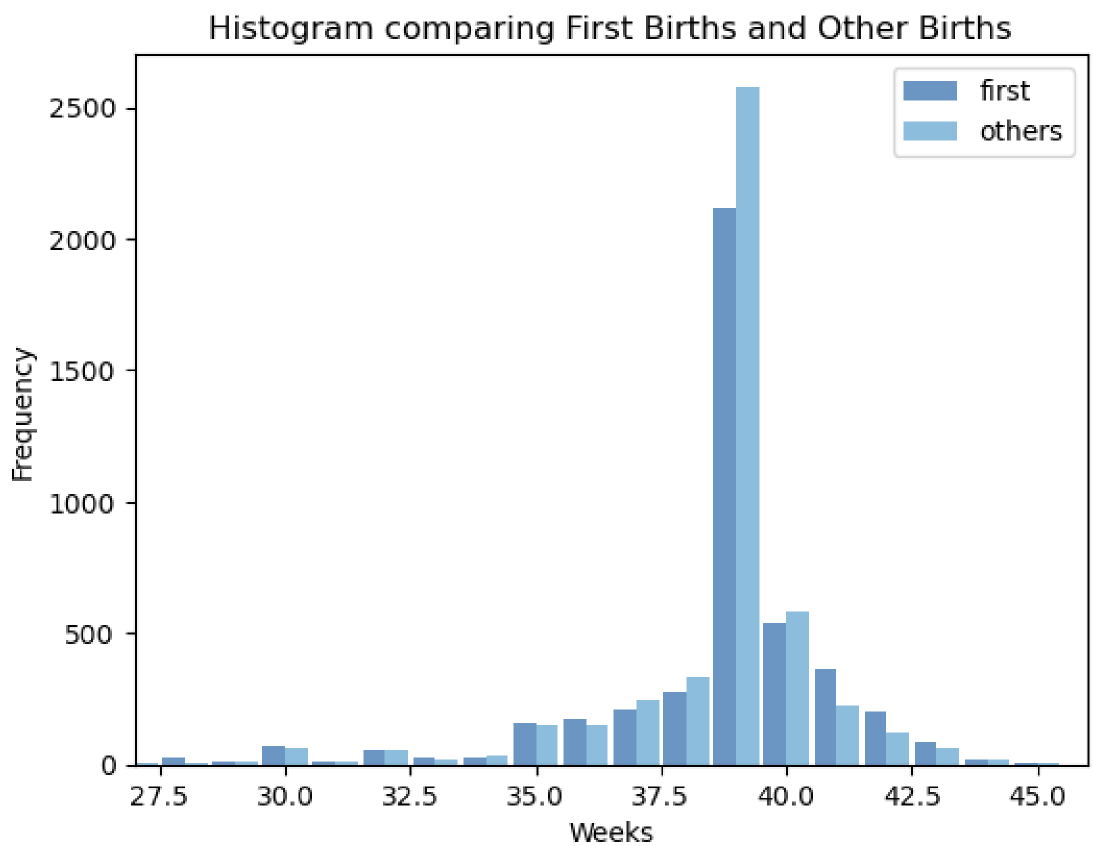
```
Mean of Live child births is 38.56055968517709
Mean of First Child births is 38.60095173351461
Mean of Other Child births is 38.52291446673706
#############################################
Variance of Live child births is 7.302662067826851
Variance of First Child births is 7.794713509229059
Variance of Other Child births is 6.842683519298573
#############################################
Standard Deviation of Live child births is 2.702343810070593
Standard Deviation of First Child births is 2.7919014146686947
Standard Deviation of Other Child births is 2.615852350439255
Cohen's d Measure of First birth and Other child birth  Pregnancy length is
0.028879044654449883
```

[29]:

```
# Creating Histograms of the Live birth Babies
hist_live = thinkstats2.Hist(np.floor(live_births.prglngth), label='prglngth')
thinkplot.Hist(hist_live)
```



[30]:
```python
# Creating Histogram of First babies and the other Babies
first_babies_hist=thinkstats2.Hist(first_babies.prglngth, label='first')
other_babies_hist=thinkstats2.Hist(other_babies.prglngth,  label='others')
thinkplot.PrePlot(2)
# Plotting the histogram by setting the alignment and the width
thinkplot.Hist(first_babies_hist,align='right',width=0.45)
thinkplot.Hist(other_babies_hist,align='left',width=0.45)
thinkplot.Show(xlabel='Weeks',ylabel='Frequency',axis=[27, 46, 0, 2700],
               title='Histogram comparing First Births and Other Births')
```




```
<Figure size 800x600 with 0 Axes>
```

Question: **Based on the results in the chapter, suppose you were asked to summarize what you learned about whether first babies arrive late**

Solution**: The Results of the Histogram indiate that most of the First babies and Other babies arrive around 38-39 weeks of Pregnancy. There is not much difference**

looking at the results of the Histogram in terms of Pregnancy length. The mean and standard deviations of these two groups can be used to compare the results which are almost same. The Mean pregnancy length of first babies is 38.6 weeks while the mean for Other babies is 38.523 weeks and the difference is almost not noticeable. So the answer to the question is Yes, the First babies arrive later than the other babies, but the difference is almost so marginally small, it is not noticeable.

Question: **Which summary statistics would you use if you wanted to get a story on evening news?**

Solution: **To get a story in the evening news, people don't like to hear the obvious facts and the topic should be either negative or something out of ordinary which mayeasily earn me a easy spot on the evening news(Pardon my opinion about the media). Hence I would pick the Outliers as the Summary Statistics to get the spot on Evening news and this will be my title:**

4.1 BREAKING NEWS : 50 Weeks of Pregnancy! Is that medically possible?

In the details of the news, I will mention that the 50 weeks pregnancy is medically unlikely and may be an outlier and talk about the mean and other summary statistics.

Question: **Which ones would you use if you wanted to reassure an anxious patient**

Solution: **Assuming the patient is not a statistics expert, I would pick the simple statistics measure that a regular person can understand. So I will go with mean Pregnancy length of First born and Other babies and explain the anxious patient how similar they are and there is not much to worry ! The difference between in the mean of the 2 groups is about 13 hours which is almoct not noticeable.**

Question: **"Do First Babies arrive late"? Write a paragraph that uses the results in the chapter to answer the question clearly, precisely and honestly**

Solution: **Based on the results in the Histogram of the Pregnancy lengths of the First babies and the other babies, we can see that the babies are born around 38-39 weeks for most of the women. Also based on the results of the mean between the groups, the difference in numbers is almost marginal that it is hardly even noticeable. The Standard Deviation between the groups also indicate that the numbers are almost similar which means we can expect about 2-3 weeks of deviation for both first babies and other babies. The Cohen's d measure confirm this observation that the measure 0.029 is almost not noticeable.**

So the short answer to the question is, YES THE FIRST BABIES DO ARRIVE LATER THAN OTHER Babies but the DIFFERENCE IS ALMOST MARGINAL that it is NOT NOTICEABLE.

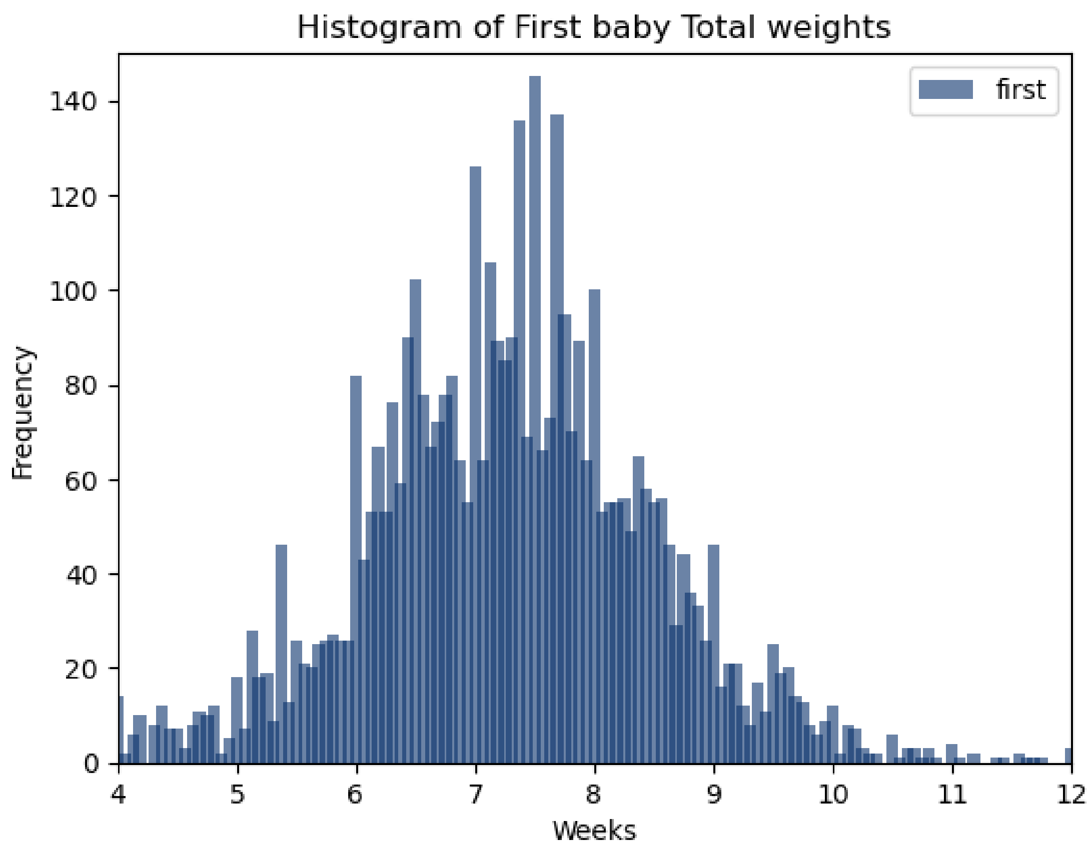
5 Exercise 2-4:

Using the totalwgt_lb, investigate whether the first babies are lighter or heavier than others. Compute Cohen's d to quantify the difference between the groups. How does it compare to the difference in Pregnancy length?

[31]:
```
# Calculating the Summary Statistics for the First Babies
mean_wgt_first = first_babies.totalwgt_lb.mean()
var_wgt_first = first_babies.totalwgt_lb.var()
std_wgt_first = first_babies.totalwgt_lb.std()

# Calculating the Summary Statistics for the Other Babies
mean_wgt_others = other_babies.totalwgt_lb.mean()
var_wgt_others = other_babies.totalwgt_lb.var()
std_wgt_others = other_babies.totalwgt_lb.std()

# Printing the results of the Summmary Statistics
print(f'Mean Weight of First Child births is {mean_wgt_first}')
print(f'Mean Weight of Other Child births is {mean_wgt_others}')
print("#############################################")

print(f'Variance of Weight of First Child births is {var_wgt_first}')
print(f'Variance of Weight of Other Child births is {var_wgt_others}')
print("#############################################")

print(f'Standard Deviation of Weight of First Child births is {std_wgt_first}')
print(f'Standard Deviation of Weight of Other Child births is {std_wgt_others}')

# Calculating Cohen's d:
mean_wgt_difference = mean_wgt_first-mean_wgt_others
len_first, len_others= len(first_babies) , len(other_babies)
pooled_var_wgt=((len_first * var_wgt_first) + (len_others * var_wgt_others))/
 ↪(len_first + len_others)
cohens_d_wgt=mean_wgt_difference /math.sqrt(pooled_var_wgt)
print(f"Cohen's d Measure of First birth and Other child birth Baby Weight is
 ↪{cohens_d_wgt}")
```

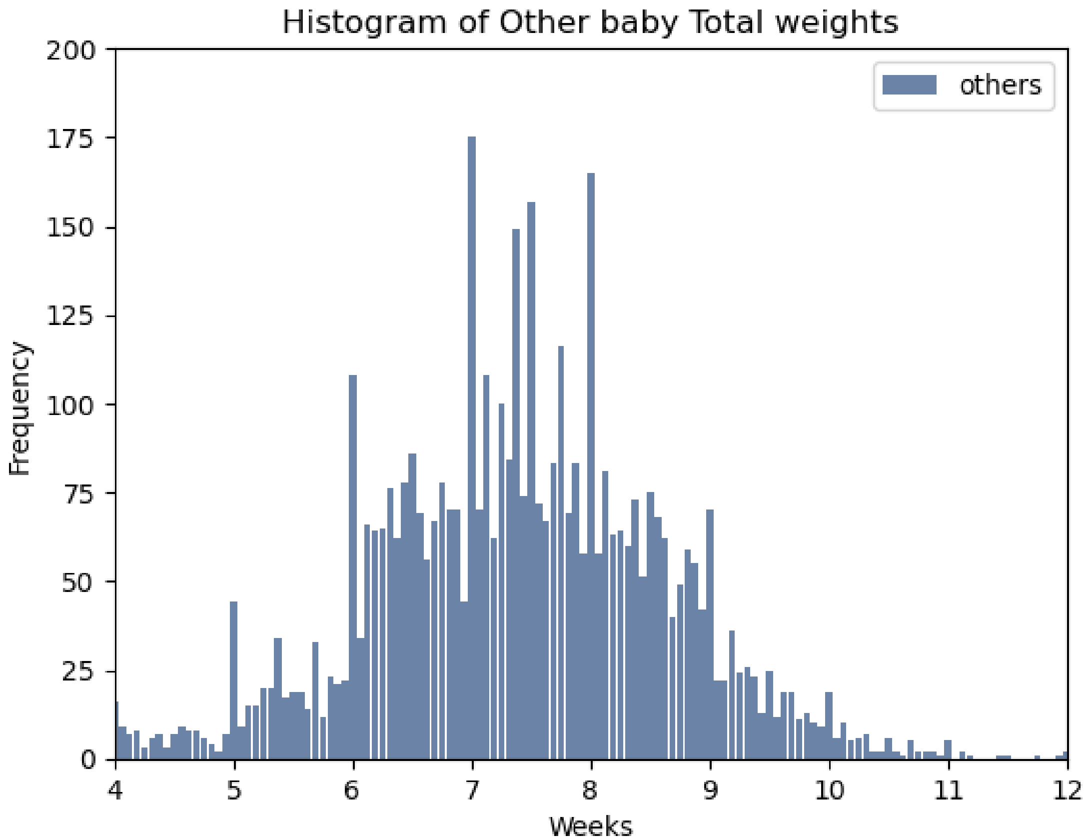
```
Mean Weight of First Child births is 7.201094430437772
Mean Weight of Other Child births is 7.325855614973262
#############################################
Variance of Weight of First Child births is 2.0180273009157768
Variance of Weight of Other Child births is 1.9437810258964572
#############################################
Standard Deviation of Weight of First Child births is 1.4205728777207374
Standard Deviation of Weight of Other Child births is 1.3941954762143138
Cohen's d Measure of First birth and Other child birth Baby Weight is
-0.088672927072602
```

[32]:
```
# Creating Histogram of First babies and the other Babies total Weights
first_babies_wgt_hist=thinkstats2.Hist(first_babies.totalwgt_lb, label='first')
other_babies_wgt_hist=thinkstats2.Hist(other_babies.totalwgt_lb, 
 ↪label='others')
# Plotting the histogram by setting the alignment and the width
thinkplot.Hist(first_babies_wgt_hist,align='center',width=0.1)
thinkplot.Show(xlabel='Weeks',ylabel='Frequency',axis=[4, 12, 0, 150],
               title='Histogram of First baby Total weights')
```




```
<Figure size 800x600 with 0 Axes>
```

[33]:
```
# Histogram of Other baby weights in pounds
thinkplot.Hist(other_babies_wgt_hist,align='center')
thinkplot.Show(xlabel='Weeks',ylabel='Frequency',axis=[4, 12, 0, 200],
               title='Histogram of Other baby Total weights')

# The Histogram results indicate that most babies weigh between 7-8 pounds when
 ↪born regardless of being first born or Other
```



<Figure size 800x600 with 0 Axes>

Solution: **The mean weights of the first babies and the other babies are almost similar which are 7.2 and 7.35 lbs respectively. The results of Standard deviation also indicate the same results that there is a difference of about 1-1.5 pounds in weights for both first born and other babies. The Cohen's d which turns out to be -0.089 which is almost marginal indicates there is no significant difference between the weights of first born and other babies. This measure is ALMOST COMPARABLE to the Cohen's d of pregnancy lengths of first and other born. The only difference is that the value is negative in this scenario. As the effect size can be either Positive or Negative, the marginal difference in the effect sizes of 2 groups are almost comparable.**