

Data Cleaning Normalization

- [Data Cleaning Normalization](#)
 - [Requirement](#)
 - [Usage](#)
 - [Input CSV](#)
 - [Check Empty Values](#)
 - [Normalization](#)
 - [Tidy Dataframe](#)
 - [Options](#)
 - [Print Dataframe](#)
 - [Modify Column Title](#)
 - [Modify cell](#)
 - [Count Values in Selected Column](#)
 - [Delete Selected Column](#)
 - [Delete Selected Row](#)
 - [Call a Cell Value](#)
 - [Output CSV](#)
 - [Change Text Case](#)
 - [Sorting](#)
 - [Quit](#)
 - [Help List](#)
 - [Flow Chart](#)
 - [Appendix](#)

Requirement

This program requires [pandas](#) and [re](#) library to run, you need to install them before running successfully.

```
pip3 install pandas
```

Usage

The program is processing data cleaning and normalization. It will detect any spaces and empty values, then transform to first normal form. After that user can reproduce a tidy CSV file.

```
python3 individual_ex.py
```

Input CSV

CSV is needed for handling firstly. By using `input_csv` function, the user require to enter the CSV in the current folder with the program or the absolute path, forming a local variable `csv_file`. User can terminate the program by typing `\q` passing through `if-else`. `Try-except` is used to prevent `No file or directory` error. The function will return to the global parameter `raw_data` to create dataframe if the program successfully read the CSV file. Otherwise, the program will print the error and force the user to input the correct file or directory again by returning to the beginning of the function.

```
raw_data = None
def input_csv(raw_data):
    try:
        csv_file = input("Input CSV file (staff_dir.csv): ")
        if csv_file == '\q': exit()
        raw_data = pd.read_csv(csv_file)
    except Exception as e:
        print(e)
        return input_csv(raw_data)
    else:
        return raw_data

print("Welcome to the data cleaning program! Type '-h' or '--help' to know the command of the program.")
raw_data = input_csv(raw_data)
df = pd.DataFrame(raw_data)
```

Result:

```
Welcome to the data cleaning program! Type '-h' or '--help' to know the command of the program.
Input CSV file (staff_dir.csv): staff_dir.csv
You have 0 columns without naming
You have 0 columns with empty cells
prog |
```

Check Empty Values

Then the program will look for empty values by calling this function automatically. It utilises the global variable `df`, searches for any `Unnamed` column and scans each cell in every column to find any empty values. Every column's name will first change to title textcase furthermore add into `empty_cols_name` and `empty_cols` list if it contains empty values. The conclusion will be shown in the console and then return to the main function.

```
def check_columns_with_empty_cell(df):

    df.columns = [' '.join(i.split()) for i in df.columns]
    empty_cols_name = [value for value in df.columns if "Unnamed" in value]
    empty_cols = [col for col in df.columns if df[col].isnull().any()]
    print("You have", len(empty_cols_name), "columns without naming")
    print("You have", len(empty_cols), "columns with empty cells")
```

```
return main()
```

Result:

```
Welcome to the data cleaning program! Type '-h' or '--help' to know the command of the program.
Input CSV file (staff_dir.csv): staff_dir.csv
You have 0 columns without naming
You have 0 columns with empty cells
prog |
```

Normalization

The program will start normalizing dataframe to first normal form by entering `-r` or `--run`. By finding columns containing `\r\n`, which means it has multiple values in a cell, it will add into a local list `column_with_multi_values` after and set an `if-else` condition to add an undiscovered column only. Then by setting index without the particular column, use `.explode()` to append the row to perform normalization. Global variable `df` is changed and automatically call `tidy_dataframe` function for cleaning data.

```
def normalization():
    global df
    column_with_multi_values = []

    for col in list(df.columns):
        df[col] = ['(' + i + ')' for i in df[col].split("\r\n")]
        for row in range(0, len(df)):
            cell_value = df[col][row]
            cell_value_list = list(map(str, cell_value.split("\r\n")))
            if (len(cell_value_list) > 1 and not col in
                column_with_multi_values): column_with_multi_values.append(col)

    for i in range(0, len(column_with_multi_values)):
        selected_column = list(column_with_multi_values[i].split(" "))
        set_index_list = [i for i in df.columns if i not in
                           selected_column]
        df = df.set_index(set_index_list)
        df = df.apply(lambda x:
            df[column_with_multi_values[i]].str.split('\r\n').explode())
        df = df.reset_index()

    print("Normalization is complete")
    return tidy_dataframe()
```

Tidy Dataframe

After normalization, the program will delete all excessive spaces tidy up the dataframe. By using `if-else` condition, all strings will change to `upper` textcase in `Location`. All special characters will be removed in `Phone` and all abbreviations will extend to long format in `Position`. After that, duplicated rows will be shown

in the console and eliminated, next the index number will be reset as the row number. Global variable `df` is changed.

```
def tidy_dataframe():
    global df

    for i in list(df.columns):
        if 'E-mail' in i: continue
        elif 'Location' in i: df[i] = [' '.join(i.split()).upper() for i in
df[i]]
        elif 'Phone' in i: df[i] = [re.sub(r"^[A-Za-z0-9]+", "", i) for i
in df[i]]
        elif 'Position' in i:
            df[i] = ['(' .join(i.split(' (')).title() for i in df[i]]
            df[i] = [i.replace("Assoc.", "Associate") for i in df[i]]
            df[i] = [re.sub(r"\bProf\b", "Professor", i) for i in df[i]]
        else: df[i] = [' '.join(i.split()).title() for i in df[i]]

    duplicateDFRow = df[df.duplicated()]
    print('Duplicated Rows: \n', duplicateDFRow)
    df = df.drop_duplicates()
    df.reset_index(inplace=True)
    del df['index']
    print("Dataframe is cleaned")

    return main()
```

Result:

```
prog -r
Normalization is complete
Duplicated Rows:
  Title Surname  Given Name  E-mail Address  Phone Number  Position  Location
15 Prof.      Tang  Akaysha Can  actang@hku.hk    25698751  Professor  MW523
16 Prof.      Tang  Akaysha Can  actang@hku.hk    25698751  Professor  MW538
17 Prof.      Tang  Akaysha Can  actang@hku.hk    25698751  Director Of The Nfe Lab  MW523
18 Prof.      Tang  Akaysha Can  actang@hku.hk    25698751  Director Of The Nfe Lab  MW538
24 Dr.        Lai    Chun    laichun@hku.hk    25698761  Associate Professor  MW623
Dataframe is cleaned
prog █
```

Options

Print Dataframe

To print the current dataframe, use `-p` or `--print`. Then it will return to the main function.

```
if usr_input == '-p' or usr_input == '--print':
    print(df)
    main()
```

Result:

```

prog -p

```

	Title	Surname	Given Name	Position	Location	E-mail Address	Phone Number
0	Prof.	GOODWIN	A. Lin	Associate Professor\r\nAssistant Dean \r\n(Lea... Dean	MW 421	alg25@hku.hk	25698745
1	Dr.	BRIDGES	Susan Margaret	Lecturer\r\n(Experiential Learning)	MW 545\r\nCPD 1.79	sbridges@hku.hk	25698746
2	Ms.	CHOW	Mei Ling Jessie	Assistant Lecturer\r\n(Experiential Learning)	MW 649	jmlchow@hku.hk	25698747
3	Ms.	MOK	Wai Fung Candace	Learning Designer	MW 647	cwfmok@hku.hk	25698748
4	Mr.	WONG	Nga Lun Alan	Post-doctoral Fellow	MW 543	alanwnl@hku.hk	2569-8749
5	Dr.	CHIAN	Monaliza Maximo	Assistant Prof	MW 528	mchian@hku.hk	25698750
6	Dr.	OUYANG	Guang	Professor\r\nDirector of the NfE Lab	MW 503\r\nMW 538	ouyangg@hku.hk	25698752
7	Prof.	TANG	Akaysha Can	Professor\r\nDirector of the NfE Lab	MW 523\r\nMW 538	actang@hku.hk	25698751
8	Prof.	TANG	Akaysha Can	Professor\r\nDirector of the NfE Lab	MW 523\r\nMW 538	actang@hku.hk	25698751
9	Dr.	Kwan	Alvin	lecturer	RM111C	cmkwan@hku.hk	2241-5324
10	Dr.	LAI	Chun	assoc. professor	MW 623	laichun@hku.hk	25698761
11	Dr.	LAM	Wai Ip	Associate Professor	MW 619	jwilam@hku.hk	25698763
12	Dr.	LAW	Yin Kum Doris	Associate Professor	MW 618	yklaw@hku.hk	25698764
13	Dr.	LIN	Chin-hsi	Associate Professor	MW 615	chinhshi@hku.hk	25698765
14	Dr.	LAI	Chun	Assoc. Professor	MW 623	laichun@hku.hk	25698761
15	Dr.	LOH	Ka Yee Elizabeth	Assistant Professor	MW 624	ekyloh@hku.hk	25698767
16	Dr.	LO	Margaret Muann	Assistant Professor	MW 662	mmlo@hku.hk	25698785

```

prog █

```

Modify Column Title

To modify a title in a selected column, use `-M` or `--modify_col_name` to change the string. Column names will be shown in the console for reminding. A local variable `col` will be formed by asking the user to type the name of the column for changing, and `i` will record the changed name. `If else` condition ensures the user to input the listed column name, otherwise ask for input again by returning to the beginning of the function. User can return to the main function by typing `\q`. Global variable `df` is changed.

```

def modify_column_name():
    global df

    print(df.columns.values)
    col = input("Name of column that you want to rename: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return modify_column_name()
    i = input("Updated name: ")
    df = df.rename(columns={col: i})
    print(f'"{col}" is changed to "{i}"')

    return main()

```

Result:

```

prog -M
['Title' 'Surname' 'Given Name' 'Position' 'Location' 'E-mail Address'
 'Phone Number']
Name of column that you want to rename: Title
Updated name: Re-Title
"Title" is changed to "Re-Title".
prog -p
    Re-Title  Surname  ...  E-mail Address Phone Number
0    Prof.  GOODWIN  ...      alg25@hku.hk      25698745

```

Modify cell

To modify a value in a selected cell, use `-m` or `--modify_cell` to change the string. Column names and numbers of the row will be shown in the console for reminding. The local variable `col` and `row` save user's input that locating to the specific cell, then change to the value in `value`. If `else` condition can prevent the user from entering an incorrect column name and row that exceeds the total number of row in the dataframe, and restrict the user to input again. User can return to the main function by typing `\q`. Global variable `df` is changed.

```
def modify_cell():
    global df

    print("Input row, column and value to a cell that you want to change")
    print("Length of dataframe is", len(df) - 1, '\n', df.columns.values)
    row = input("Number of Row: ")
    col = input("Name of Column: ")
    if (col == '\q' or row == '\q'): return main()
    elif col not in df.columns.values or not row.isnumeric(): return
    modify_cell()
    row = int(row)
    if row > len(df) - 1: return modify_cell()
    value = input("Value: ")

    df.iloc[row, df.columns.get_loc(col)] = value
    print(f'The value of row {row} in "{col}" is changed to "{value}".')

    return main()
```

Result:

```
prog -m
Input row, column and value to a cell that you want to change
Length of dataframe is 16
['Title' 'Surname' 'Given Name' 'Position' 'Location' 'E-mail Address'
 'Phone Number']
Number of Row: 0
Name of Column: Surname
Value: Chan
The value of row 0 in "Surname" is changed to "Chan".
prog -p
```

	Title	Surname	...	E-mail Address	Phone Number
0	Prof.	Chan	...	alg25@hku.hk	25698745

Count Values in Selected Column

To count the number of values in a specific column, use `-C` or `--count_column`. Column names will be shown in the console for reminding. User's input will save in the local variable `col` to calculate the sum of values. If `else` condition can prevent the user from inputting incorrect column name, and restrict the user to input again. Then print in the console. User can return to the main function by typing `\q`.

```
def counting_with_a_column():
    global df

    print(df.columns.values)
    col = input("Select a column to count: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return counting_with_a_column()
    selected_column = [i for i in df[col]]
    selected_column = {i: selected_column.count(i) for i in
selected_column}
    for key, value in selected_column.items():
        print(key, value)

    return main()
```

Result:

```
prog -C
['Title' 'Surname' 'Given Name' 'E-mail Address' 'Phone Number' 'Position'
'Location']
Select a column to count: Title
Prof. 5
Dr. 14
Ms. 2
Mr. 1
```

Delete Selected Column

Use `-D` or `--remove_col` to delete a selected column. User's input will save in the local variable `i` to delete. Column names will be shown in the console for reminding. If `else` condition can prevent the user from inputting incorrect column name, and restrict the user to input again. User can return to the main function by typing `\q`. Global variable `df` is changed.

```
def remove_selected_column():
    global df

    print(df.columns.values)
    i = input("Type the name of column to delete: ")
    if i == '\q': return main()
    elif i not in df.columns.values: return remove_selected_column()
    else: del df[i]
    print(f'"{i}" is removed.')

    return main()
```

Result:

```

prog -d
['Title' 'Surname' 'Given Name' 'E-mail Address' 'Phone Number' 'Position'
 'Location']
Type the name of column to delete: Title
"Title" is removed.
prog -p
      Surname  ... Location
0   Goodwin   ...   MW421

```

Delete Selected Row

Use `-d` or `--remove_row` to delete a selected row. User's input will save in the local variable `row` to delete. Numbers of the row will be shown in the console for reminding. If `else` condition can prevent the user from inputting the incorrect number of row, and restrict the user to input again. User can return to the main function by typing `\q`. Global variable `df` is changed.

```

def remove_selected_row():
    global df

    print(len(df))
    row = input("Number of row to remove: ")
    if row == '\q': return main()
    elif not row.isnumeric(): return remove_selected_row()
    row = int(row)
    if row > len(df) - 1: return remove_selected_row()
    df.drop([row], axis=0, inplace=True)
    print(f'Row {row} is removed.')

    return main()

```

Result:

```

prog -d
17
Number of row to remove: 0
Row 0 is removed.
prog -p
      Title  Surname  ...  E-mail Address  Phone Number
1      Dr.  BRIDGES  ...  sbridges@hku.hk      25698746

```

Call a Cell Value

Use `-v` or `--view_value` to view the value with a selected cell. Column names and numbers of the row will be shown in the console for reminding. User's input will save in the local variable `row` and `col` to view a cell value. If `else` condition can prevent the user from the inputting incorrect number of row and the name of a column, and restrict the user to input again. User can return to the main function by typing `\q`.

```
def receive_cell_value():
    print('Length of the row is', len(df) - 1)
    row = input("Number of Row: ")
    if row == '\q': return main()
    elif not row.isnumeric(): return receive_cell_value()
    row = int(row)
    if row > len(df) - 1: return receive_cell_value()

    print(df.columns.values)
    col = input("Name of Column: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return receive_cell_value()
    print('The value is', df.loc[row, col])

    return main()
```

Result:

```
prog -v
Length of the row is 16
Number of Row: 0
['Title' 'Surname' 'Given Name' 'Position' 'Location' 'E-mail Address'
 'Phone Number']
Name of Column: Title
The value is Prof.
```

Output CSV

Use `-o` or `--gen_csv` to specify the name of CSV for creating a new CSV. The local variable `output` save the name of the new CSV file. User can return to the main function by typing `\q`.

```
def to_csv():
    global df

    output = input("Name of the new csv file: ")
    if output == '\q': return main()
    df.to_csv(f'{output}.csv', index=0)
    print(f'{output}.csv is generated.')

    return main()
```

```
prog -o
Name of the new csv file: output
output.csv is generated.
```

Result:

Change Text Case

To change values to selected textcase within a particular column, use `-t` or `--text_case`. Column names will be shown in the console for reminding. The local variable `col` and `val` save the name of column and selected textcase. User type `up` to change the textcase to `upper`, type `lo` for `lower` and `ti` for `title` textcase. If `else` condition can prevent the user from inputting incorrect name of column and type of textcase, and restrict the user to input again. User can return to the main function by typing `\q`. Global variable `df` is changed.

```
def change_text_case():
    global df

    print(df.columns.values)
    col = input("Name of column to change: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return change_text_case()

    val = input("\'up\' for upper, \'lo\' for lower or \'ti\' for title: ")
    if val == '\q': return main()
    elif val == 'up': df[col] = [' '.join(i.split()).upper() for i in df[col]]
    elif val == 'lo': df[col] = [' '.join(i.split()).lower() for i in df[col]]
    elif val == 'ti': df[col] = [' '.join(i.split()).title() for i in df[col]]
    else:
        print('Invalid input!')
        return change_text_case()

    print(f'The textcase of "{col}" is changed.')
    return main()
```

Result:

```

prog -t
['Title' 'Surname' 'Given Name' 'E-mail Address' 'Phone Number' 'Position'
 'Location']
Name of column to change: Title
'up' for upper, 'lo' for lower or 'ti' for title: up
The textcase of "Title" is changed.
prog -p

```

	Title	Surname	...		Position	Location
0	PROF.	Goodwin	...		Dean	MW421

Sorting

Use `-s` or `--sort` to sort the dataframe by the selected column. Column names will be shown in the console for reminding. The local variable `col` and `val` save the name of column and selected pattern of sorting. User type `de` for descending order and `as` for ascending order. If `else` condition can prevent the user from inputting incorrect name of column and type of pattern, and restrict the user to input again. User can return to the main function by typing `\q`. Global variable `df` is changed. The index will reset to generate new row numbers series.

```

def sort_by_column():
    global df

    print(df.columns.values)
    col = input("Name of column to sort: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return sort_by_column()
    val = input("\'as\' for ascending or \'de\' for descending: ")
    if val == '\q': return main()
    elif val == 'de': df = df.sort_values(by=[col], ascending = False)
    elif val == 'as': df = df.sort_values(by=[col], ascending = True)
    else:
        print('Invalid input!')
        return sort_by_column()

    df.reset_index(inplace=True)
    del df['index']
    print(f'The order of "{col}" is changed.')
    return main()

```

Result:

```
prog -s
['Title' 'Surname' 'Given Name' 'E-mail Address' 'Phone Number' 'Position'
 'Location']
Name of column to sort: Surname
'as' for ascending or 'de' for descending: as
The order of "Surname" is changed.
prog -p
      Title  Surname  ...                               Position Location
0      DR.  Bridges  ...                               Associate Professor  MW545
```

Quit

Use `\q` or `--quit` to exit the program.

```
def quit_prog():
    print("Thank you and Goodbye")
    exit()
```

```
prog \q
Thank you and Goodbye
```

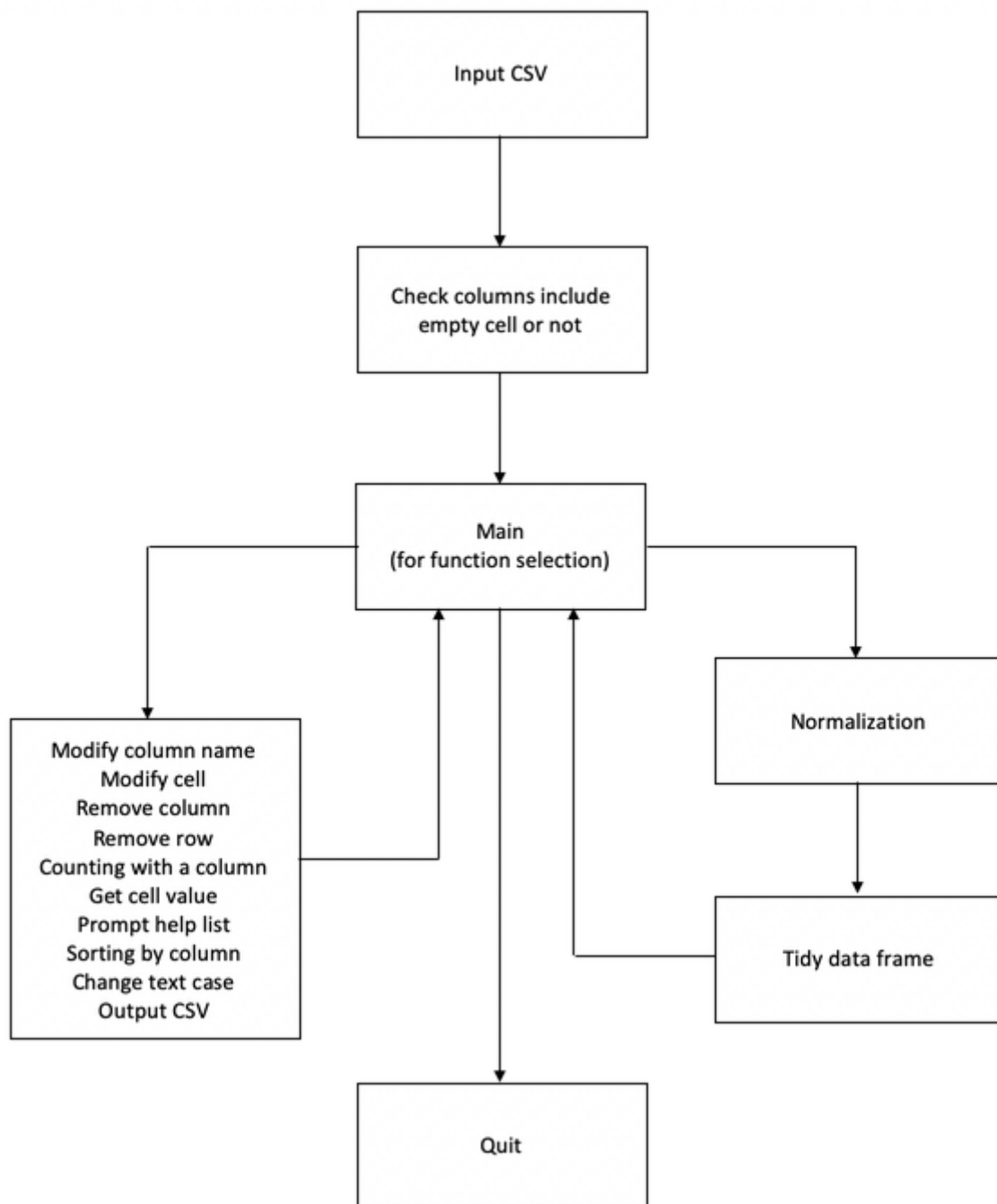
Result:

Help List

The help information is generated based on the information commander already knows about the program. The default help option is `-h, --help`.

<code>-p, --print</code>	Print all dataframe
<code>-C, --count_column</code>	Count the number of the cell values of a selected column
<code>-m, --modify_cell</code>	Modify the selected cell value
<code>-M, --modify_col_name</code>	Modify the selected column name
<code>-D, --del_col</code>	Remove the selected column
<code>-d, --del_row</code>	Remove the selected row
<code>-v, --view_value</code>	View the selected cell value
<code>-o, --gen_csv</code>	Generate CSV file for database
<code>-s, --sort</code>	Sort the dataframe by selected column
<code>-t, --textcase</code>	Change values textcase
<code>\q, --quit</code>	Quit the program
<code>-h, --help</code>	Show command list

Flow Chart



Appendix

```

import pandas as pd
import re

raw_data = None

def input_csv(raw_data):
    try:
        csv_file = input("Input CSV file (staff_dir.csv): ")

```

```

        if csv_file == '\q': exit()
        raw_data = pd.read_csv(csv_file)
    except Exception as e:
        print(e)
        return input_csv(raw_data)
    else:
        return raw_data

def check_columns_with_empty_cell(df):

    df.columns = [' '.join(i.split()) for i in df.columns]
    empty_cols_name = [value for value in df.columns if "Unnamed" in
value]
    empty_cols = [col for col in df.columns if df[col].isnull().any()]
    print("You have", len(empty_cols_name), "columns without naming")
    print("You have", len(empty_cols), "columns with empty cells")

    return main()

# -M
def modify_column_name():
    global df

    print(df.columns.values)
    col = input("Name of column that you want to rename: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return modify_column_name()
    i = input("Updated name: ")
    df = df.rename(columns={col: i})
    print(f'"{col}" is changed to "{i}"')

    return main()

# -m
def modify_cell():
    global df

    print("Input row, column and value to a cell that you want to change")
    print("Length of dataframe is", len(df) - 1, '\n', df.columns.values)
    row = input("Number of Row: ")
    col = input("Name of Column: ")
    if (col == '\q' or row == '\q'): return main()
    elif col not in df.columns.values or not row.isnumeric(): return
modify_cell()
    row = int(row)
    if row > len(df) - 1: return modify_cell()
    value = input("Value: ")

    df.iloc[row, df.columns.get_loc(col)] = value
    print(f'The value of row {row} in "{col}" is changed to "{value}"')

    return main()

# -D

```

```

def remove_selected_column():
    global df

    print(df.columns.values)
    i = input("Type the name of column to delete: ")
    if i == '\q': return main()
    elif i not in df.columns.values: return remove_selected_column()
    else: del df[i]

    print(f'"{i}" is removed.')

    return main()

# -C
def counting_with_a_column():
    global df

    print(df.columns.values)
    col = input("Select a column to count: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return counting_with_a_column()
    selected_column = [i for i in df[col]]
    selected_column = {i: selected_column.count(i) for i in
selected_column}
    for key, value in selected_column.items():
        print(key, value)

    return main()

# -d
def remove_selected_row():
    global df

    print(len(df))
    row = input("Number of row to remove: ")
    if row == '\q': return main()
    elif not row.isnumeric(): return remove_selected_row()
    row = int(row)
    if row > len(df) - 1: return remove_selected_row()
    df.drop([row], axis=0, inplace=True)
    print(f'Row {row} is removed.')

    return main()

# -r
def normalization():
    global df
    column_with_multi_values = []

    for col in list(df.columns):
        df[col] = ['(' .join(i.split("\r\n")) for i in df[col]]
        for row in range(0, len(df)):
            cell_value = df[col][row]
            cell_value_list = list(map(str, cell_value.split("\r\n")))

```

```

        if (len(cell_value_list) > 1 and not col in
column_with_multi_values): column_with_multi_values.append(col)

    for i in range(0, len(column_with_multi_values)):
        selected_column = list(column_with_multi_values[i].split(" "))
        set_index_list = [i for i in df.columns if i not in
selected_column]
        df = df.set_index(set_index_list)
        df = df.apply(lambda x:
df[column_with_multi_values[i]].str.split('\r\n').explode())
        df = df.reset_index()

    print("Normalization is complete")
    return tidy_dataframe()

def tidy_dataframe():
    global df

    for i in list(df.columns):
        if 'E-mail' in i: continue
        elif 'Location' in i: df[i] = [' '.join(i.split()).upper() for i in
df[i]]
        elif 'Phone' in i: df[i] = [re.sub(r"^[A-Za-z0-9]+", "", i) for i
in df[i]]
        elif 'Position' in i:
            df[i] = ['(' .join(i.split(' (')).title() for i in df[i]]
            df[i] = [i.replace("Assoc.", "Associate") for i in df[i]]
            df[i] = [re.sub(r"\bProf\b", "Professor", i) for i in df[i]]
        else: df[i] = [' ' .join(i.split()).title() for i in df[i]]

    duplicateDFRow = df[df.duplicated()]
    print('Duplicated Rows: \n', duplicateDFRow)
    df = df.drop_duplicates()
    df.reset_index(inplace=True)
    del df['index']
    print("Dataframe is cleaned")

    return main()

# -v
def receive_cell_value():
    print('Length of the row is', len(df) - 1)
    row = input("Number of Row: ")
    if row == '\q': return main()
    elif not row.isnumeric(): return receive_cell_value()
    row = int(row)
    if row > len(df) - 1: return receive_cell_value()

    print(df.columns.values)
    col = input("Name of Column: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return receive_cell_value()
    print('The value is', df.loc[row, col])

```



```

        return main()

# -o
def to_csv():
    global df

    output = input("Name of the new csv file: ")
    if output == '\q': return main()
    df.to_csv(f'{output}.csv', index=0)
    print(f'{output}.csv is generated.')

    return main()

# -s
def sort_by_column():
    global df

    print(df.columns.values)
    col = input("Name of column to sort: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return sort_by_column()
    val = input("\'as\' for ascending or \'de\' for descending: ")
    if val == '\q': return main()
    elif val == 'de': df = df.sort_values(by=[col], ascending = False)
    elif val == 'as': df = df.sort_values(by=[col], ascending = True)
    else:
        print('Invalid input!')
        return sort_by_column()

    df.reset_index(inplace=True)
    del df['index']
    print(f'The order of "{col}" is changed.')

    return main()

# -t
def change_text_case():
    global df

    print(df.columns.values)
    col = input("Name of column to change: ")
    if col == '\q': return main()
    elif col not in df.columns.values: return change_text_case()

    val = input("\'up\' for upper, \'lo\' for lower or \'ti\' for title: ")
    if val == '\q': return main()
    elif val == 'up': df[col] = [' '.join(i.split()).upper() for i in df[col]]
    elif val == 'lo': df[col] = [' '.join(i.split()).lower() for i in df[col]]
    elif val == 'ti': df[col] = [' '.join(i.split()).title() for i in df[col]]
    else:

```

```

        print('Invalid input!')
        return change_text_case()

    print(f'The textcase of "{col}" is changed.')
    return main()

# \q
def quit_prog():
    print("Thank you and Goodbye")
    exit()

# -h
def help_list():
    print("\n%-5s %-20s %-30s" % ("-p,", "--print", "Print all
dataframe"))
    print("%-5s %-20s %-30s" % ("-C,", "--count_column", "Count the number
of the cell values of a selected column"))
    print("%-5s %-20s %-30s" % ("-m,", "--modify_cell", "Modify the
selected cell value"))
    print("%-5s %-20s %-30s" % ("-M,", "--modify_col_name", "Modify the
selected column name"))
    print("%-5s %-20s %-30s" % ("-D,", "--del_col", "Remove the selected
column"))
    print("%-5s %-20s %-30s" % ("-d,", "--del_row", "Remove the selected
row"))
    print("%-5s %-20s %-30s" % ("-v,", "--view_value", "View the selected
cell value"))
    print("%-5s %-20s %-30s" % ("-o,", "--gen_csv", "Generate CSV file for
database"))
    print("%-5s %-20s %-30s" % ("-s,", "--sort", "Sort the dataframe by
selected column"))
    print("%-5s %-20s %-30s" % ("-t,", "--textcase", "Change values
textcase"))
    print("%-5s %-20s %-30s" % ("\q,", "--quit", "Quit the program"))
    print("%-5s %-20s %-30s" % ("-h,", "--help", "Show command list\n"))

    return main()

def main():
    global df

    usr_input = input('prog ')
    if usr_input == '-p' or usr_input == '--print':
        print(df)
        main()
    elif usr_input == '-C' or usr_input == '--count_column':
        counting_with_a_column()
    elif usr_input == '-m' or usr_input == '--modify_cell':
        modify_cell()
    elif usr_input == '-M' or usr_input == '--modify_col_name':
        modify_column_name()
    elif usr_input == '-D' or usr_input == '--remove_col':
        remove_selected_column()
    elif usr_input == '-d' or usr_input == '--remove_row':
        remove_selected_row()

```

```
        elif usr_input == '-v' or usr_input == '--view_value':
receive_cell_value()
        elif usr_input == '-o' or usr_input == '--gen_csv': to_csv()
        elif usr_input == '-r' or usr_input == '--run': normalization()
        elif usr_input == '-s' or usr_input == '--sort': sort_by_column()
        elif usr_input == '-t' or usr_input == '--text_case':
change_text_case()
        elif usr_input == '\q' or usr_input == '--quit': quit_prog()
        elif usr_input == '-h' or usr_input == '--help': help_list()
        else:
            print("Invalid input. Please type again.")
            main()

# Start
print("Welcome to the data cleaning program! Type '-h' or '--help' to know
the command of the program.")
raw_data = input_csv(raw_data)
df = pd.DataFrame(raw_data)
check_columns_with_empty_cell(df)
```