Code & Output

EX 9.2

Code:

```
# Julia Cuellar
# DSC 550
# Final project

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import statsmodels.api as sm
from statsmodels.formula.api import ols


# Display pizza place data
def read_file():
    pizza = pd.read_csv('pizzaplace.csv')
    print('Original pizza data:\n', pizza)


# Display described, summarized, and length of pizza place data
def des_sum_len():
    pizza = pd.read_csv('pizzaplace.csv')
    print('Described pizza data:\n', pizza.describe())
    print('Summarized pizza data:\n', pizza.describe(include=['O']))
    print('Length of pizza data:\n', len(pizza))


# Display bar chart of pizza name
def showBar_Pname():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza['name'].value_counts().plot(kind='barh').invert_yaxis()
    plt.title('Pizza name')
    plt.show()


# Display bar chart of pizza size
def showBar_Psize():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza['size'].value_counts().plot(kind='barh')
    plt.title('Pizza size')
    plt.show()


# Display pie chart of pizza type
def showPie_Ptype():
    pizza = pd.read_csv('pizzaplace.csv')
    plt.pie(pizza['type'].value_counts(), autopct=lambda p: f'{p:.2f}%',
labels=['classic', 'supreme', 'veggie',

'chicken'])
    plt.title('Pizza type')
    plt.show()
```

```
# Display boxplot of pizza price
def showBoxplot_Pprice():
    pizza = pd.read_csv('pizzaplace.csv')
    sns.boxplot(pizza['price'])
    plt.title('Pizza price')
    plt.show()


# Check the nulls from pizza file
def check_null():
    pizza = pd.read_csv('pizzaplace.csv')
    print("Display pizza data with null:\n", pizza.isnull())
    print("Display counts of null from pizza data:\n", pizza.isnull().sum())


# Rename unname column then drop along with id and date
def rename_drop():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    print('Pizza data updated:\n', pizza.head(5))


# Check for outlier in pizza size column by counts
def size_count():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    print('Pizza size count:\n', pizza['size'].value_counts())


# Check for outlier in pizza price column by describe then remove and update
def price_out_r_up():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    print('Pizza price:\n', pizza['price'].describe())
    p_price = pizza[pizza['price'] >= 35].index
    pizza.drop(p_price, inplace=True)
    print('Described pizza price:\n', pizza['price'].describe())
    sns.boxplot(pizza['price'])
    plt.title('Pizza price updated')
    plt.show()


# Redisplay pizza place data with described, summarized, and length
def pizza_up():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    p_price = pizza[pizza['price'] >= 35].index
    pizza.drop(p_price, inplace=True)
    print('Pizza data updated:\n', pizza)
    print('Described pizza data updated:\n', pizza.describe())
    print('Summarized pizza data updated:\n', pizza.describe(include=['O']))
```

```
    print('Length of pizza data updated:\n', len(pizza))


# Create a multiple linear regression model for size of pizza vs type of
pizza purchased
def reg_model_svt():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    p_price = pizza[pizza['price'] >= 35].index
    pizza.drop(p_price, inplace=True)
    fit = ols('price ~ C(size) + C(type)', data=pizza).fit()
    print("Multiple linear regression model for size of pizza vs type of
pizza purchased:\n", fit.summary())
    res = fit.resid
    fig = sm.qqplot(res, fit=True, line="45")
    plt.title('Multiple linear regression plot')
    plt.show()


# Display frequency table for size of pizza vs type of pizza purchased
def showFT_svt():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    p_price = pizza[pizza['price'] >= 35].index
    pizza.drop(p_price, inplace=True)
    pizza_svt = pd.crosstab(pizza['size'], pizza['type'])
    print("Cross table of size of pizza vs type of pizza purchased:\n",
pizza_svt)


# Create a simple linear regression model for name of pizza vs price of pizza
purchased
def reg_model_nvp():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    p_price = pizza[pizza['price'] >= 35].index
    pizza.drop(p_price, inplace=True)
    fit = ols('price ~ C(name)', data=pizza).fit()
    print("Simple linear regression model for name of pizza vs price of pizza
purchased:\n", fit.summary())
    res = fit.resid
    fig = sm.qqplot(res, fit=True, line="45")
    plt.title('Simple linear regression plot')
    plt.show()


# Display plot for name of pizza vs type of pizza purchased
def showPlot_nvp():
    pizza = pd.read_csv('pizzaplace.csv')
    pizza.rename(columns={'Unnamed: 0': 'num'}, inplace=True)
    pizza.drop(['num', 'id', 'date'], axis=1, inplace=True)
    p_price = pizza[pizza['price'] >= 35].index
    pizza.drop(p_price, inplace=True)
    sns.catplot(x='price', y='name', data=pizza)
```

```
    plt.title('Price vs Name')
    plt.show()
    pizza_nvp = pd.crosstab(pizza['price'], pizza['name'])
    print("Cross table of price of pizza vs name of pizza purchased:\n",
pizza_nvp)
    pizza_name = pizza.groupby('name').count()
    print("Display count of pizza name:\n", pizza_name)
    pizza_price = pizza.groupby('price').count()
    print("Display count of pizza price:\n", pizza_price)


if __name__ == "__main__":
    read_file()
    des_sum_len()
    showBar_Pname()
    showBar_Psize()
    showPie_Ptype()
    showBoxplot_Pprice()
    check_null()
    rename_drop()
    size_count()
    price_out_r_up()
    pizza_up()
    reg_model_svt()
    showFT_svt()
    reg_model_nvp()
    showPlot_nvp()
```

Output:

Original pizza data:

```
      Unnamed: 0         id       date  ... size     type  price
0              1  2015-000001  2015-01-01  ...    M  classic  13.25
1              2  2015-000002  2015-01-01  ...    M  classic  16.00
2              3  2015-000002  2015-01-01  ...    M   veggie  16.00
3              4  2015-000002  2015-01-01  ...    L  chicken  20.75
4              5  2015-000002  2015-01-01  ...    L   veggie  18.50
...          ...         ...         ...  ... ...  ...     ...    ...
49569      49570  2015-021348  2015-12-31  ...    L   veggie  17.95
49570      49571  2015-021348  2015-12-31  ...    S  classic  12.00
49571      49572  2015-021348  2015-12-31  ...    M  chicken  16.75
49572      49573  2015-021349  2015-12-31  ...    L   veggie  20.25
49573      49574  2015-021350  2015-12-31  ...    S  chicken  12.75

[49574 rows x 8 columns]
```

Described pizza data:

```
         Unnamed: 0         price
count  49574.000000  49574.000000
mean   24787.500000     16.497762
std    14310.925459      3.621954
min        1.000000      9.750000
25%    12394.250000     12.750000
50%    24787.500000     16.500000
75%    37180.750000     20.250000
max    49574.000000     35.950000
```

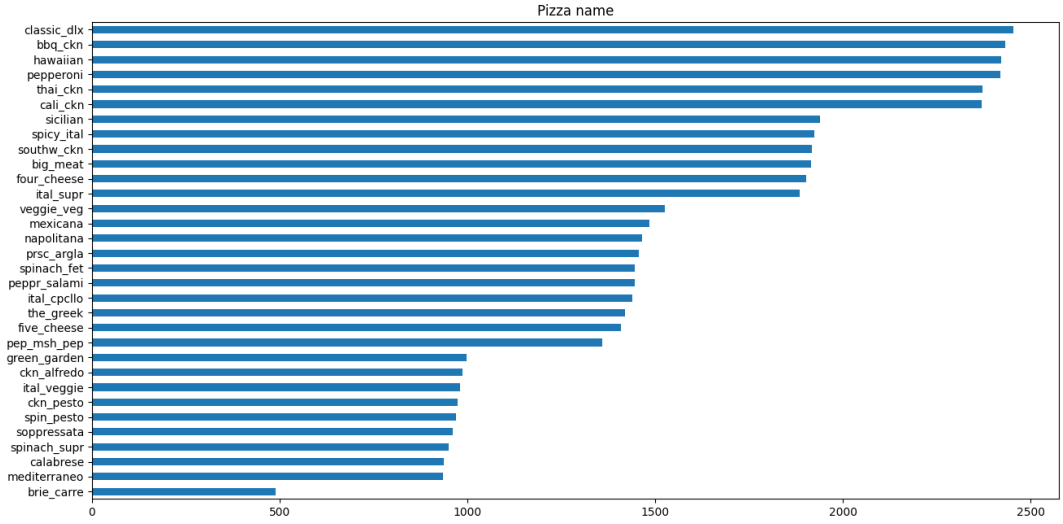
Summarized pizza data:

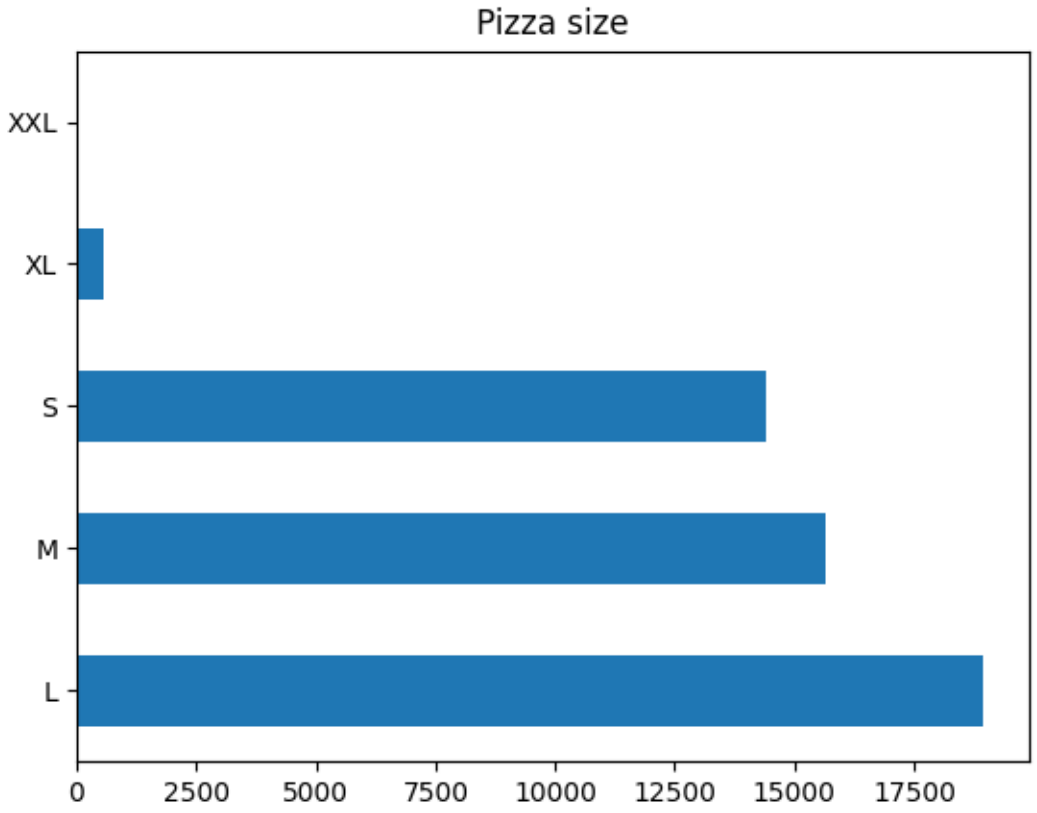
```
                id       date      time         name   size     type
```

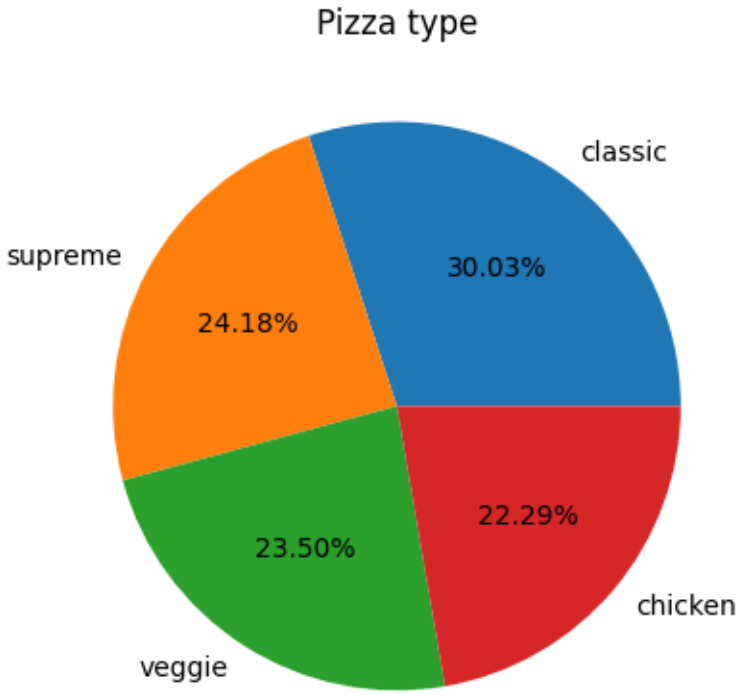
count	49574	49574	49574	49574	49574	49574
unique	21350	358	16382	32	5	4
top	2015-018845	2015-11-26	12:25:12	classic_dlx	L	classic
freq	28	266	28	2453	18956	14888

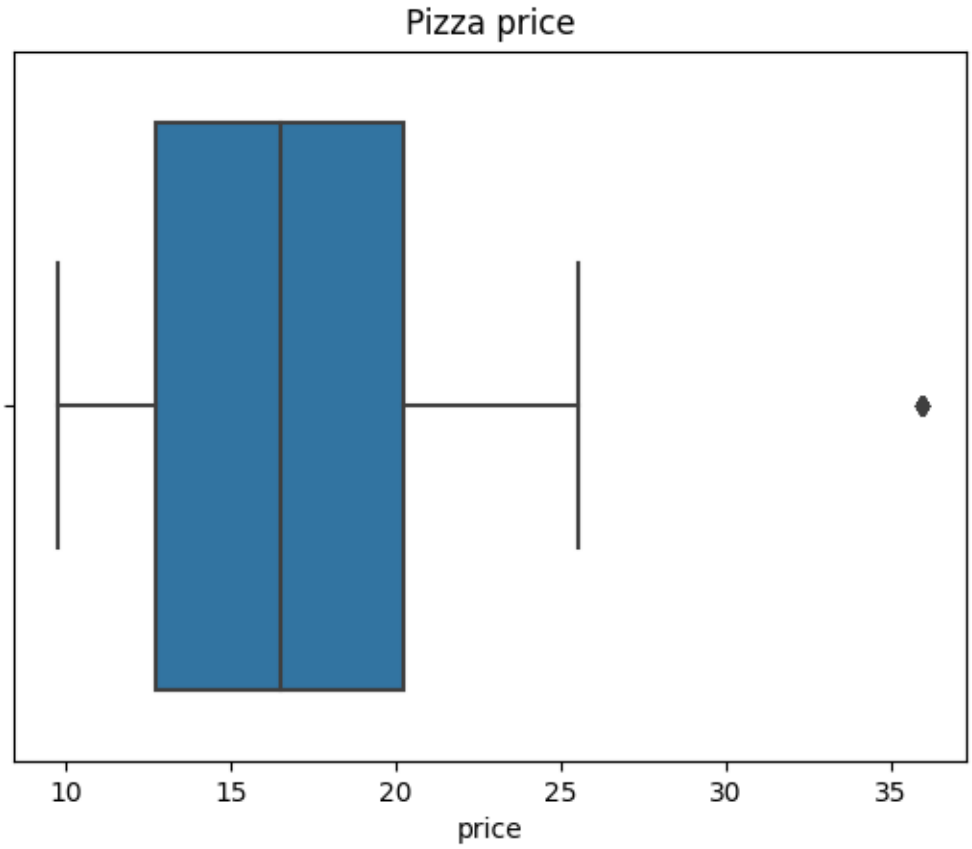
Length of pizza data:

49574




Pizza size
XXL
XL
S
M
L
0
2500
5000
7500
10000
12500
15000
17500


Pizza type
classic
supreme
30.03%
24.18%
22.29%
23.50%
chicken
veggie



Display pizza data with null:

	Unnamed: 0	id	date	time	name	size	type	price
0	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...	...
49569	False	False	False	False	False	False	False	False
49570	False	False	False	False	False	False	False	False
49571	False	False	False	False	False	False	False	False
49572	False	False	False	False	False	False	False	False
49573	False	False	False	False	False	False	False	False

[49574 rows x 8 columns]

Display counts of null from pizza data:

```
 Unnamed: 0    0
id             0
date           0
time           0
name           0
size           0
type           0
price          0
dtype: int64
```

Pizza data updated:

	time	name	size	type	price
0	11:38:36	hawaiian	M	classic	13.25
1	11:57:40	classic_dlx	M	classic	16.00
2	11:57:40	mexicana	M	veggie	16.00
3	11:57:40	thai_ckn	L	chicken	20.75
4	11:57:40	five_cheese	L	veggie	18.50

Pizza size count:

```
 L      18956
M       15635
S       14403
XL        552
XXL        28
Name: size, dtype: int64
```

Pizza price:

```
 count    49574.000000
```

mean 16.497762

std 3.621954

min 9.750000

25% 12.750000

50% 16.500000

75% 20.250000

max 35.950000

Name: price, dtype: float64

Described pizza price:

count 49546.000000

mean 16.486769

std 3.593327

min 9.750000

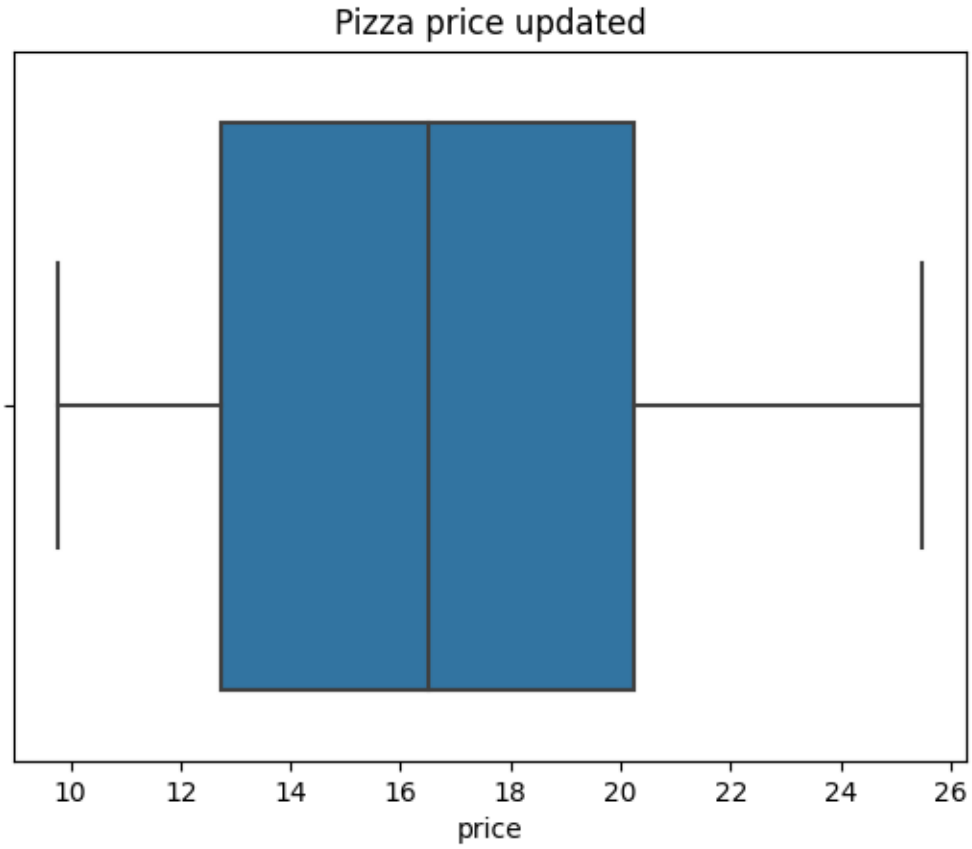
25% 12.750000

50% 16.500000

75% 20.250000

max 25.500000

Name: price, dtype: float64



Pizza data updated:

	time	name	size	type	price
0	11:38:36	hawaiian	M	classic	13.25
1	11:57:40	classic_dlx	M	classic	16.00
2	11:57:40	mexicana	M	veggie	16.00
3	11:57:40	thai_ckn	L	chicken	20.75
4	11:57:40	five_cheese	L	veggie	18.50
...	...	...	...	...	...
49569	21:23:10	four_cheese	L	veggie	17.95
49570	21:23:10	napolitana	S	classic	12.00
49571	21:23:10	ckn_alfredo	M	chicken	16.75
49572	22:09:54	mexicana	L	veggie	20.25
49573	23:02:05	bbq_ckn	S	chicken	12.75

[49546 rows x 5 columns]

Described pizza data updated:

	price
count	49546.000000
mean	16.486769
std	3.593327
min	9.750000
25%	12.750000
50%	16.500000
75%	20.250000
max	25.500000

Summarized pizza data updated:

	time	name	size	type
count	49546	49546	49546	49546
unique	16378	32	4	4
top	12:25:12	classic_dlx	L	classic
freq	28	2453	18956	14860

Length of pizza data updated:

49546

Multiple linear regression model for size of pizza vs type of pizza purchased:

OLS Regression Results

Dep. Variable:	price	R-squared:	0.847
Model:	OLS	Adj. R-squared:	0.847
Method:	Least Squares	F-statistic:	4.570e+04
Date:	Wed, 17 Feb 2021	Prob (F-statistic):	0.00
Time:	14:44:08	Log-Likelihood:	-87171.

No. Observations: 49546 AIC: 1.744e+05

Df Residuals: 49539 BIC: 1.744e+05

Df Model: 6

Covariance Type: nonrobust

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	20.5052	0.015	1343.493	0.000	20.475	20.535
C(size)[T.M]	-3.8127	0.015	-250.543	0.000	-3.843	-3.783
C(size)[T.S]	-7.1114	0.016	-448.156	0.000	-7.143	-7.080
C(size)[T.XL]	7.0274	0.062	113.857	0.000	6.906	7.148
C(type)[T.classic]	-2.0326	0.018	-112.266	0.000	-2.068	-1.997
C(type)[T.supreme]	0.1538	0.019	8.277	0.000	0.117	0.190
C(type)[T.veggie]	-1.0795	0.019	-57.800	0.000	-1.116	-1.043

Omnibus: 38426.463 Durbin-Watson: 2.006

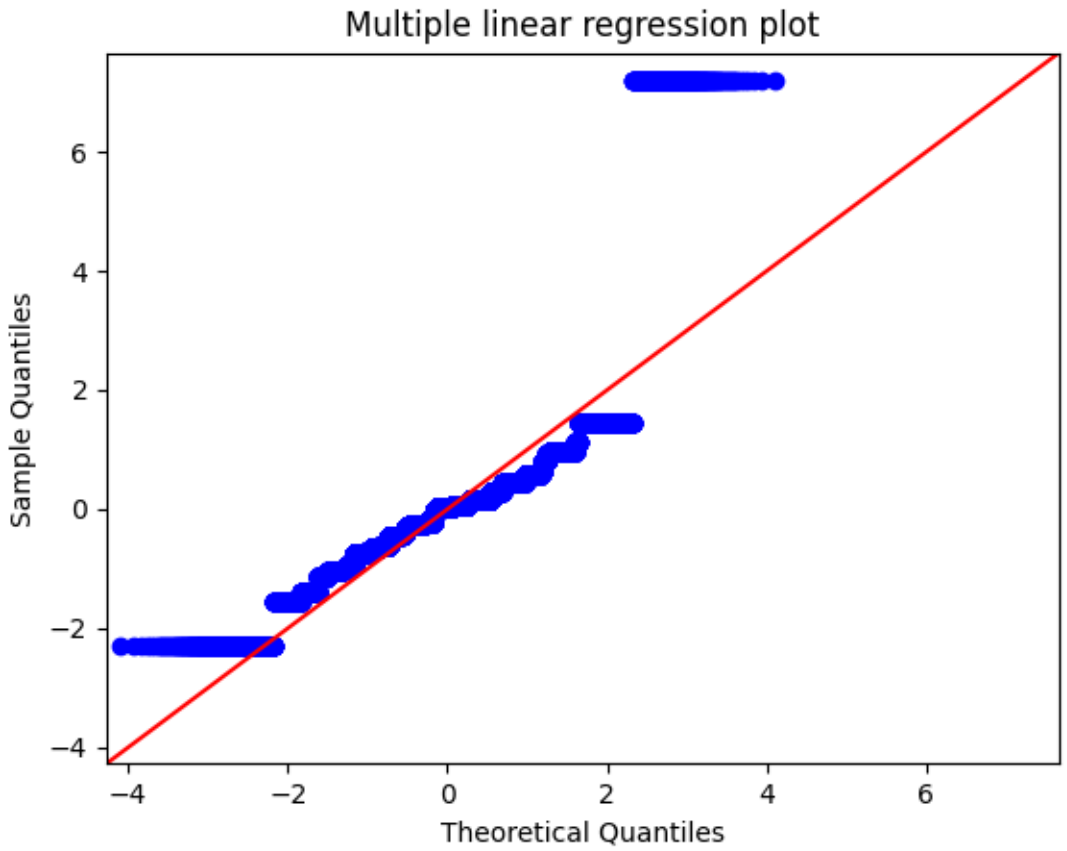
Prob(Omnibus): 0.000 Jarque-Bera (JB): 1319807.442

Skew: 3.452 Prob(JB): 0.00

Kurtosis: 27.324 Cond. No. 11.7

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.



Cross table of size of pizza vs type of pizza purchased:

size	type chicken	classic	supreme	veggie
L	4932	4057	4564	5403
M	3894	4112	4046	3583
S	2224	6139	3377	2663
XL	0	552	0	0

Simple linear regression model for name of pizza vs price of pizza purchased:

OLS Regression Results

==========

Dep. Variable: price R-squared: 0.315

Model: OLS Adj. R-squared: 0.314

Method:	Least Squares	F-statistic:	733.8
Date:	Wed, 17 Feb 2021	Prob (F-statistic):	0.00
Time:	14:44:17	Log-Likelihood:	-1.2431e+05
No. Observations:	49546	AIC:	2.487e+05
Df Residuals:	49514	BIC:	2.490e+05
Df Model:	31		
Covariance Type:	nonrobust		

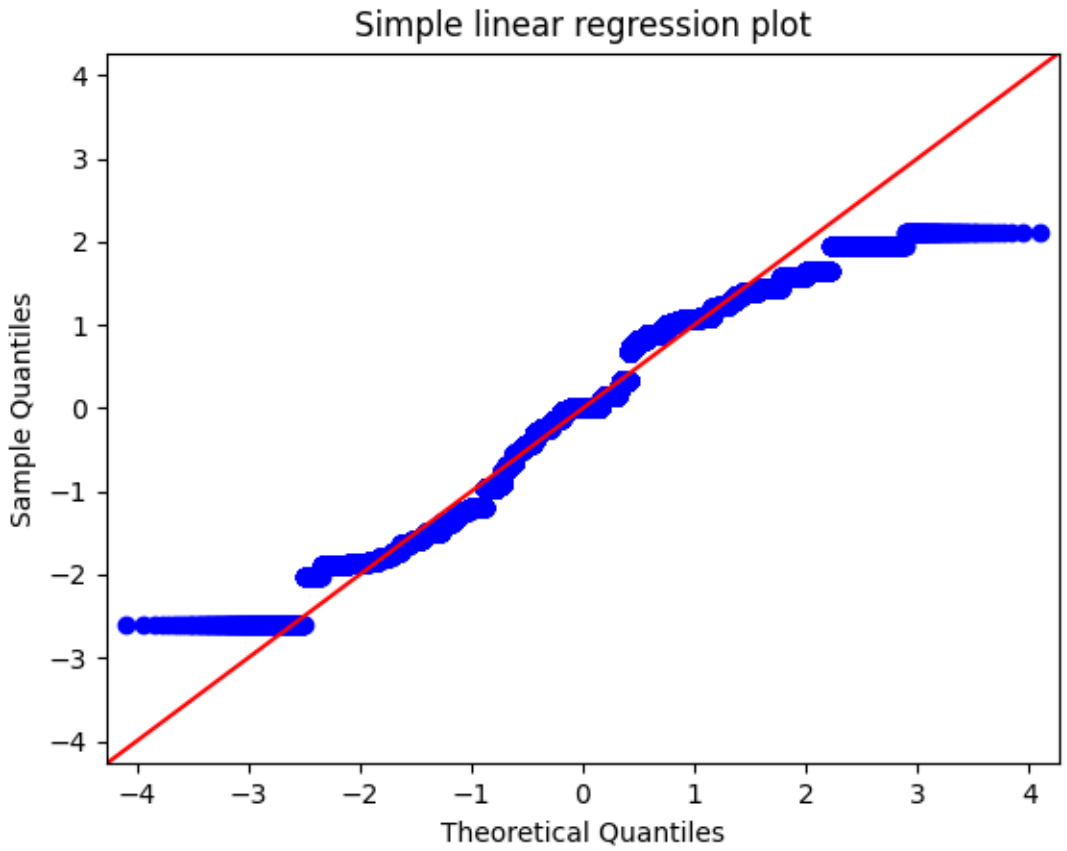
	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	17.5855	0.060	291.468	0.000	17.467	17.704
C(name)[T.big_meat]	-5.5855	0.091	-61.436	0.000	-5.764	-5.407
C(name)[T.brie_carre]	6.0645	0.147	41.161	0.000	5.776	6.353
C(name)[T.calabrese]	-0.5799	0.114	-5.069	0.000	-0.804	-0.356
C(name)[T.cali_ckn]	-0.1132	0.086	-1.318	0.188	-0.281	0.055
C(name)[T.ckn_alfredo]	-0.4627	0.112	-4.120	0.000	-0.683	-0.243
C(name)[T.ckn_pesto]	-0.4203	0.113	-3.724	0.000	-0.642	-0.199
C(name)[T.classic_dlx]	-2.0207	0.085	-23.733	0.000	-2.188	-1.854
C(name)[T.five_cheese]	0.9145	0.100	9.180	0.000	0.719	1.110
C(name)[T.four_cheese]	-0.6214	0.091	-6.823	0.000	-0.800	-0.443
C(name)[T.green_garden]	-3.5878	0.112	-32.065	0.000	-3.807	-3.368
C(name)[T.hawaiian]	-4.2605	0.085	-49.881	0.000	-4.428	-4.093
C(name)[T.ital_cpcllo]	-0.1349	0.099	-1.363	0.173	-0.329	0.059
C(name)[T.ital_supr]	0.1834	0.091	2.009	0.045	0.004	0.362
C(name)[T.ital_veggie]	-1.2560	0.113	-11.161	0.000	-1.477	-1.035
C(name)[T.mediterraneo]	-1.1396	0.115	-9.950	0.000	-1.364	-0.915
C(name)[T.mexicana]	0.4608	0.098	4.702	0.000	0.269	0.653
C(name)[T.napolitana]	-1.1327	0.098	-11.508	0.000	-1.326	-0.940

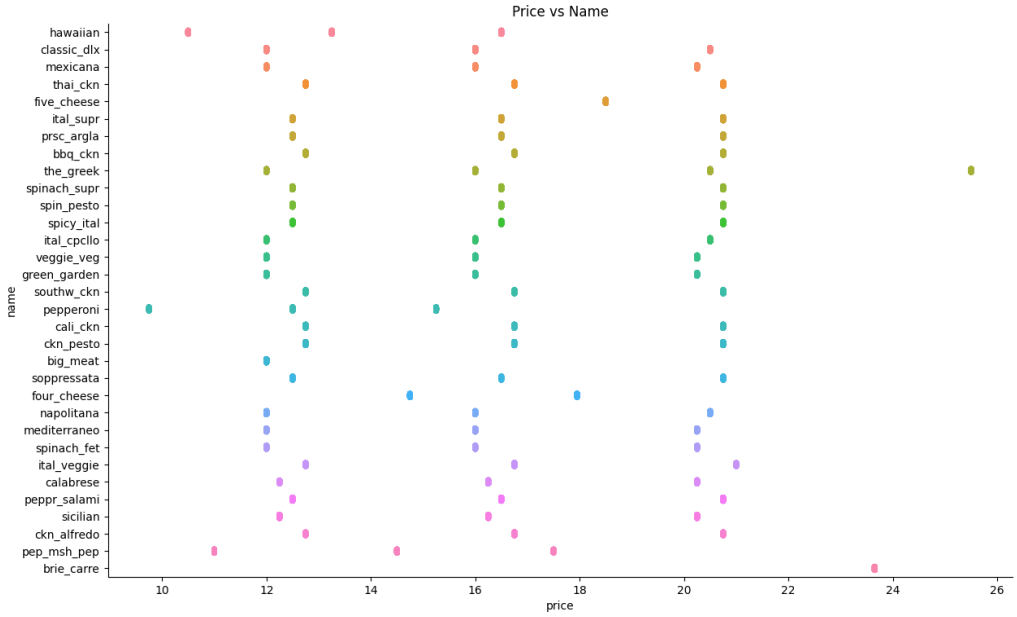
C(name)[T.pep_msh_pep]	-3.7264	0.101	-36.980	0.000	-3.924	-3.529
C(name)[T.pepperoni]	-5.1117	0.085	-59.821	0.000	-5.279	-4.944
C(name)[T.peppr_salami]	0.0694	0.099	0.702	0.483	-0.124	0.263
C(name)[T.prsc_argla]	-0.9807	0.099	-9.949	0.000	-1.174	-0.787
C(name)[T.sicilian]	-1.6204	0.091	-17.885	0.000	-1.798	-1.443
C(name)[T.soppressata]	-0.4932	0.113	-4.350	0.000	-0.715	-0.271
C(name)[T.southw_ckn]	0.5187	0.091	5.707	0.000	0.341	0.697
C(name)[T.spicy_ital]	0.5180	0.091	5.706	0.000	0.340	0.696
C(name)[T.spin_pesto]	-1.5072	0.113	-13.339	0.000	-1.729	-1.286
C(name)[T.spinach_fet]	-1.4920	0.099	-15.100	0.000	-1.686	-1.298
C(name)[T.spinach_supr]	-1.5037	0.114	-13.209	0.000	-1.727	-1.281
C(name)[T.thai_ckn]	0.7334	0.086	8.541	0.000	0.565	0.902
C(name)[T.the_greek]	2.1325	0.100	21.325	0.000	1.937	2.329
C(name)[T.veggie_veg]	-1.6126	0.097	-16.596	0.000	-1.803	-1.422

Omnibus:	4627.087	Durbin-Watson:	1.993
Prob(Omnibus):	0.000	Jarque-Bera (JB):	1698.323
Skew:	-0.211	Prob(JB):	0.00
Kurtosis:	2.197	Cond. No.	26.7

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.





Cross table of price of pizza vs name of pizza purchased:

name	bbq_ckn	big_meat	brie_carre	...	thai_ckn	the_greek	veggie_veg

price				...			
9.75	0	0	0	...	0	0	0
10.50	0	0	0	...	0	0	0
11.00	0	0	0	...	0	0	0
12.00	0	1914	0	...	0	304	464
12.25	0	0	0	...	0	0	0
12.50	0	0	0	...	0	0	0
12.75	484	0	0	...	480	0	0
13.25	0	0	0	...	0	0	0
14.50	0	0	0	...	0	0	0
14.75	0	0	0	...	0	0	0
15.25	0	0	0	...	0	0	0
16.00	0	0	0	...	0	281	635
16.25	0	0	0	...	0	0	0
16.50	0	0	0	...	0	0	0
16.75	956	0	0	...	481	0	0
17.50	0	0	0	...	0	0	0
17.95	0	0	0	...	0	0	0
18.50	0	0	0	...	0	0	0
20.25	0	0	0	...	0	0	427
20.50	0	0	0	...	0	255	0
20.75	992	0	0	...	1410	0	0
21.00	0	0	0	...	0	0	0
23.65	0	0	490	...	0	0	0
25.50	0	0	0	...	0	552	0

[24 rows x 32 columns]

Display count of pizza name:

name	time	size	type	price
bbq_ckn	2432	2432	2432	2432
big_meat	1914	1914	1914	1914
brie_carre	490	490	490	490
calabrese	937	937	937	937
cali_ckn	2370	2370	2370	2370
ckn_alfredo	987	987	987	987
ckn_pesto	973	973	973	973
classic_dlx	2453	2453	2453	2453
five_cheese	1409	1409	1409	1409
four_cheese	1902	1902	1902	1902
green_garden	997	997	997	997
hawaiian	2422	2422	2422	2422
ital_cpcllo	1438	1438	1438	1438
ital_supr	1884	1884	1884	1884
ital_veggie	981	981	981	981
mediterraneo	934	934	934	934
mexicana	1484	1484	1484	1484
napolitana	1464	1464	1464	1464
pep_msh_pep	1359	1359	1359	1359
pepperoni	2418	2418	2418	2418
peppr_salami	1446	1446	1446	1446
prsc_argla	1457	1457	1457	1457
sicilian	1938	1938	1938	1938
soppressata	961	961	961	961
southw_ckn	1917	1917	1917	1917
spicy_ital	1924	1924	1924	1924

spin_pesto 970 970 970 970

spinach_fet 1446 1446 1446 1446

spinach_supr 950 950 950 950

thai_ckn 2371 2371 2371 2371

the_greek 1392 1392 1392 1392

veggie_veg 1526 1526 1526 1526

Display count of pizza price:

time name size type

price

9.75 751 751 751 751

10.50 1020 1020 1020 1020

11.00 578 578 578 578

12.00 5744 5744 5744 5744

12.25 850 850 850 850

12.50 3380 3380 3380 3380

12.75 2529 2529 2529 2529

13.25 483 483 483 483

14.50 397 397 397 397

14.75 586 586 586 586

15.25 728 728 728 728

16.00 4522 4522 4522 4522

16.25 1136 1136 1136 1136

16.50 4111 4111 4111 4111

16.75 4380 4380 4380 4380

17.50 384 384 384 384

17.95 1316 1316 1316 1316

18.50 1409 1409 1409 1409

20.25 3093 3093 3093 3093

20.50	2026	2026	2026	2026
20.75	8891	8891	8891	8891
21.00	190	190	190	190
23.65	490	490	490	490
25.50	552	552	552	552