In [1]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
```

In [7]:
```
file_path = "src/cars.csv"
data = pd.read_csv(file_path)
```

Описание набора данных

- Источник
- Набор данных состоит из 1 файла cars.csv.
- Данный набор содержит информацию о подержанных и новых автомобилях, выставленных на продажу в США. Данные были собраны с аукционного сайта AUCTION EXPORT.com и включают сведения о 28 автомобильных брендах. Для каждого автомобиля в наборе представлено 12 характеристик, таких как цена, пробег, год выпуска и техническое состояние. Набор позволяет анализировать рынок автомобилей, сравнивать стоимость марок и моделей, а также изучать зависимость цены от параметров вроде пробега или региона продажи.

- **Price** - Integer - The sale price of the vehicle in the ad
- **Years** - Integer - The vehicle registration year
- **Brand** - String - The brand of car
- **Model** - String - model of the vehicle
- **Color** - String - Color of the vehicle
- **State/City** - String - The location in which the car is being available for purchase
- **Mileage** - Float - miles traveled by vehicle
- **Vin** - String - The vehicle identification number is a collection of 17 characters (digits and capital letters)
- **Title Status** - String - This feature included binary classification, which are clean title vehicles and salvage insurance
- **Lot** - Integer - A lot number is an identification number assigned to a particular quantity or lot of material from a single manufacturer. For cars, a lot number is combined with a serial number to form the Vehicle Identification Number.
- **Condition** - String - Time

In [8]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2499 entries, 0 to 2498
Data columns (total 13 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   Unnamed: 0    2499 non-null   int64  
 1   price         2499 non-null   int64  
 2   brand         2499 non-null   object 
 3   model         2499 non-null   object 
 4   year          2499 non-null   int64  
 5   title_status  2499 non-null   object 
 6   mileage       2499 non-null   float64
 7   color         2499 non-null   object 
 8   vin           2499 non-null   object 
 9   lot           2499 non-null   int64  
 10  state         2499 non-null   object 
 11  country       2499 non-null   object 
 12  condition     2499 non-null   object 
dtypes: float64(1), int64(4), object(8)
memory usage: 253.9+ KB
```

In [9]:
```
data.describe()
```

Out[9]:

	Unnamed: 0	price	year	mileage	lot
count	2499.000000	2499.000000	2499.000000	2.499000e+03	2.499000e+03
mean	1249.000000	18767.671469	2016.714286	5.229869e+04	1.676914e+08
std	721.543484	12116.094936	3.442656	5.970552e+04	2.038772e+05
min	0.000000	0.000000	1973.000000	0.000000e+00	1.593488e+08
25%	624.500000	10200.000000	2016.000000	2.146650e+04	1.676253e+08
50%	1249.000000	16900.000000	2018.000000	3.536500e+04	1.677451e+08
75%	1873.500000	25555.500000	2019.000000	6.347250e+04	1.677798e+08
max	2498.000000	84900.000000	2020.000000	1.017936e+06	1.678055e+08

In [12]:
```
#трансформация данных
data=data.drop("model",axis=1)
data['country'] = data['country'].astype(str)
data= data.drop("vin",axis=1)
data= data.drop("lot",axis=1)
data=data.drop("country",axis=1)
data['title_status'] = data['title_status'].astype(str)
data['condition'] = data['condition'].astype(str)
data['color'] = data['color'].astype(str)
```

In [13]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2499 entries, 0 to 2498
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   Unnamed: 0    2499 non-null   int64  
 1   price         2499 non-null   int64  
 2   brand         2499 non-null   object 
 3   year          2499 non-null   int64  
 4   title_status  2499 non-null   object 
 5   mileage       2499 non-null   float64
 6   color         2499 non-null   object 
 7   state         2499 non-null   object 
 8   condition     2499 non-null   object 
dtypes: float64(1), int64(3), object(5)
memory usage: 175.8+ KB
```

In [15]:
```
data['status_b'] = data['title_status'].apply(lambda x: 1 if x == 'clean vehicle
```

In [16]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2499 entries, 0 to 2498
Data columns (total 10 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   Unnamed: 0    2499 non-null   int64  
 1   price         2499 non-null   int64  
 2   brand         2499 non-null   object 
 3   year          2499 non-null   int64  
 4   title_status  2499 non-null   object 
 5   mileage       2499 non-null   float64
 6   color         2499 non-null   object 
 7   state         2499 non-null   object 
 8   condition     2499 non-null   object 
 9   status_b      2499 non-null   int64  
dtypes: float64(1), int64(4), object(5)
memory usage: 195.4+ KB
```

ЗАДАНИЕ 1

Задача №3. Для набора данных проведите кодирование одного (произвольного) категориального признака с использованием метода "weight of evidence (WoE) encoding".

In [21]:
```
woe_table = data.groupby('brand')['status_b'].agg(['count', 'sum'])
woe_table.columns = ['total', 'good']  # 'sum' = количество Good (1)
woe_table['bad'] = woe_table['total'] - woe_table['good']  # количество Bad (0)


total_good = woe_table['good'].sum()
total_bad = woe_table['bad'].sum()

woe_table['woe'] = np.log(
    (woe_table['good'] / total_good) / (woe_table['bad'] / total_bad)
)

data['brand_woe'] = data['brand'].map(woe_table['woe'])
```

```
C:\Users\Necron\Desktop\code\ml\env\Lib\site-packages\pandas\core\arraylike.py:399: RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

In [22]:
```
data
```

Out[22]:

	Unnamed: 0	price	brand	year	title_status	mileage	color	state	condit
0	0	6300	toyota	2008	clean vehicle	274117.0	black	new jersey	10 c
1	1	2899	ford	2011	clean vehicle	190552.0	silver	tennessee	6 c
2	2	5350	dodge	2018	clean vehicle	39590.0	silver	georgia	2 c
3	3	25000	ford	2014	clean vehicle	64146.0	blue	virginia	22 hc
4	4	27700	chevrolet	2018	clean vehicle	6654.0	red	florida	22 hc
...	...	...	...	...	...	...	...	...	
2494	2494	7800	nissan	2019	clean vehicle	23609.0	red	california	1 c
2495	2495	9200	nissan	2018	clean vehicle	34553.0	silver	florida	21 hc
2496	2496	9200	nissan	2018	clean vehicle	31594.0	silver	florida	21 hc
2497	2497	9200	nissan	2018	clean vehicle	32557.0	black	florida	2 c
2498	2498	9200	nissan	2018	clean vehicle	31371.0	silver	florida	21 hc

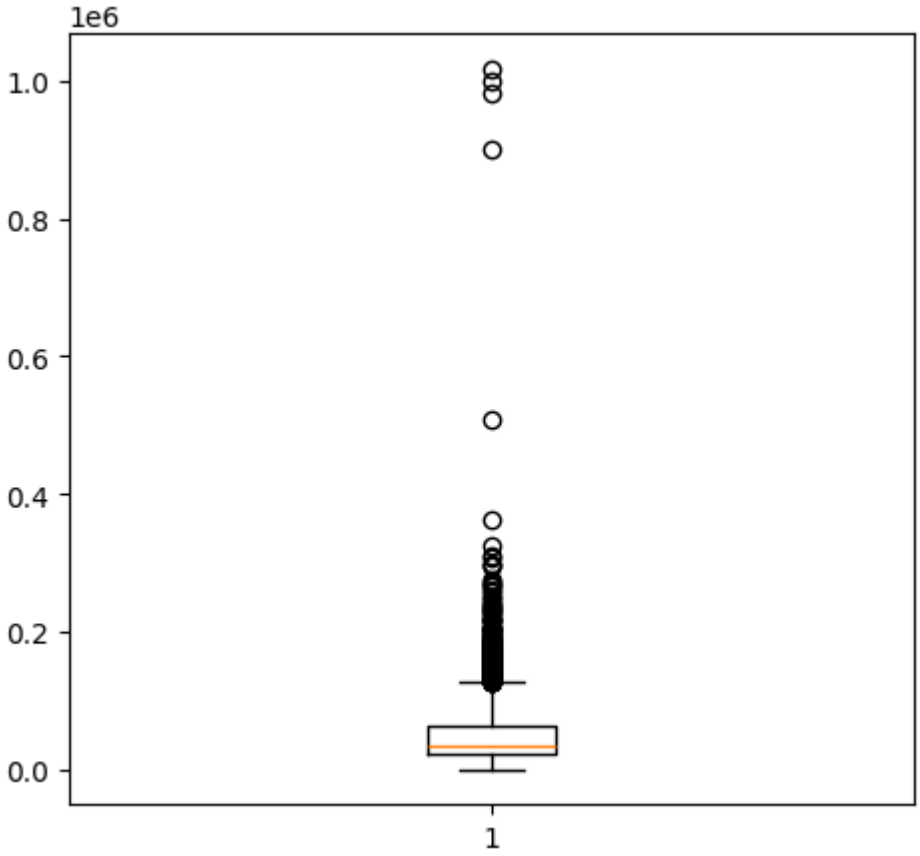
2499 rows × 11 columns

ЗАДАНИЕ 2

Задача №23. Для набора данных для одного (произвольного) числового признака проведите обнаружение и удаление выбросов на основе правила трех сигм.

In [25]:
```
plt.figure(figsize=(12, 5))
plt.subplot(1, 2, 1)
plt.boxplot(data['mileage'])
```

Out[25]:
```
{'whiskers': [<matplotlib.lines.Line2D at 0x1ed76884710>,
  <matplotlib.lines.Line2D at 0x1ed76894990>],
 'caps': [<matplotlib.lines.Line2D at 0x1ed76895790>,
  <matplotlib.lines.Line2D at 0x1ed76896110>],
 'boxes': [<matplotlib.lines.Line2D at 0x1ed7688c7d0>],
 'medians': [<matplotlib.lines.Line2D at 0x1ed76896a10>],
 'fliers': [<matplotlib.lines.Line2D at 0x1ed76897290>],
 'means': []}
```



In [30]:
```
mu = data['mileage'].mean()
sigma = data['mileage'].std()

lower_bound = mu - 3 * sigma
upper_bound = mu + 3 * sigma

outliers = data[(data['mileage'] < lower_bound) | (data['mileage'] > upper_bound
print(len(outliers))
outliers
```

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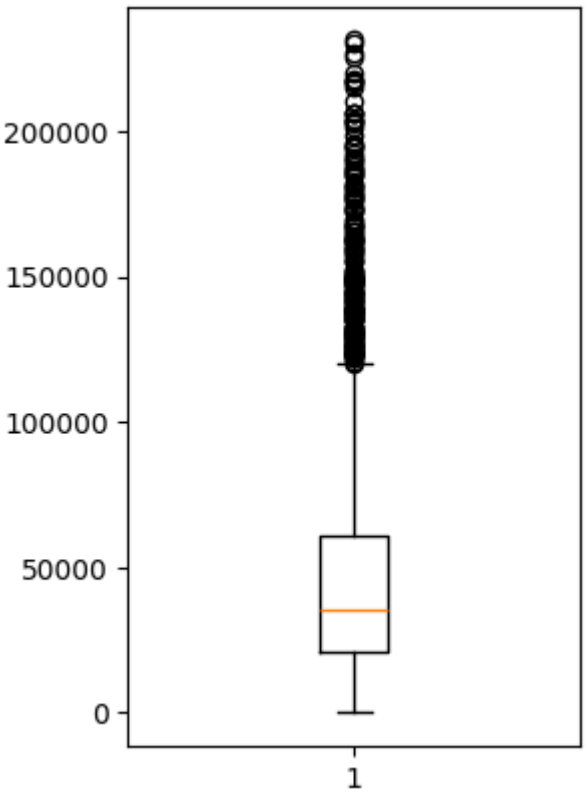
Out[30]:

	Unnamed: 0	price	brand	year	title_status	mileage	color	state	con
0	0	6300	toyota	2008	clean vehicle	274117.0	black	new jersey	1
182	182	3800	chevrolet	2009	clean vehicle	261648.0	white	michigan	
197	197	15700	ford	2011	clean vehicle	309564.0	white	south carolina	21
293	293	0	chevrolet	1998	salvage insurance	258631.0	gray	texas	17
305	305	0	ford	2003	salvage insurance	246065.0	gold	kansas	
311	311	7320	chevrolet	2008	clean vehicle	325611.0	silver	florida	22
330	330	0	ford	1996	salvage insurance	296860.0	green	california	19
340	340	350	ford	2004	salvage insurance	236980.0	gray	illinois	17
347	347	0	gmc	2004	salvage insurance	235348.0	gold	south carolina	
367	367	2725	chevrolet	2004	salvage insurance	308451.0	black	south carolina	
387	387	4600	ford	2006	salvage insurance	240740.0	brown	mississippi	
395	395	25	ford	1998	salvage insurance	300021.0	brown	arkansas	17
410	410	0	chevrolet	1995	salvage insurance	274706.0	green	arizona	
443	443	0	chevrolet	2008	salvage insurance	270080.0	yellow	illinois	17
447	447	75	ford	2001	salvage insurance	295780.0	gold	arkansas	17
455	455	0	chevrolet	2006	salvage insurance	268040.0	silver	texas	17
466	466	25	chevrolet	2007	salvage insurance	267834.0	black	texas	17
490	490	475	peterbilt	2012	salvage insurance	902041.0	gold	florida	17
496	496	0	ford	1996	salvage insurance	252588.0	red	oklahoma	17
516	516	0	peterbilt	2009	salvage insurance	982486.0	blue	florida	17

	Unnamed: 0	price	brand	year	title_status	mileage	color	state	con
528	528	1025	peterbilt	2010	salvage insurance	1017936.0	color:	georgia	17
531	531	2000	chevrolet	2003	clean vehicle	507985.0	red	wisconsin	21
950	950	1300	dodge	2013	salvage insurance	239822.0	gray	michigan	
1827	1827	3200	ford	2013	clean vehicle	999999.0	silver	south carolina	21
1873	1873	8000	ford	2014	salvage insurance	231769.0	yellow	florida	16
1880	1880	8000	ford	2013	salvage insurance	250831.0	color:	new jersey	16
1974	1974	2825	ford	2014	salvage insurance	363810.0	white	montana	17
2415	2415	800	nissan	2012	salvage insurance	234792.0	black	florida	

In [31]:
```
data_upd = data[(data['mileage'] >= lower_bound) & (data['mileage'] <= upper_bou
```

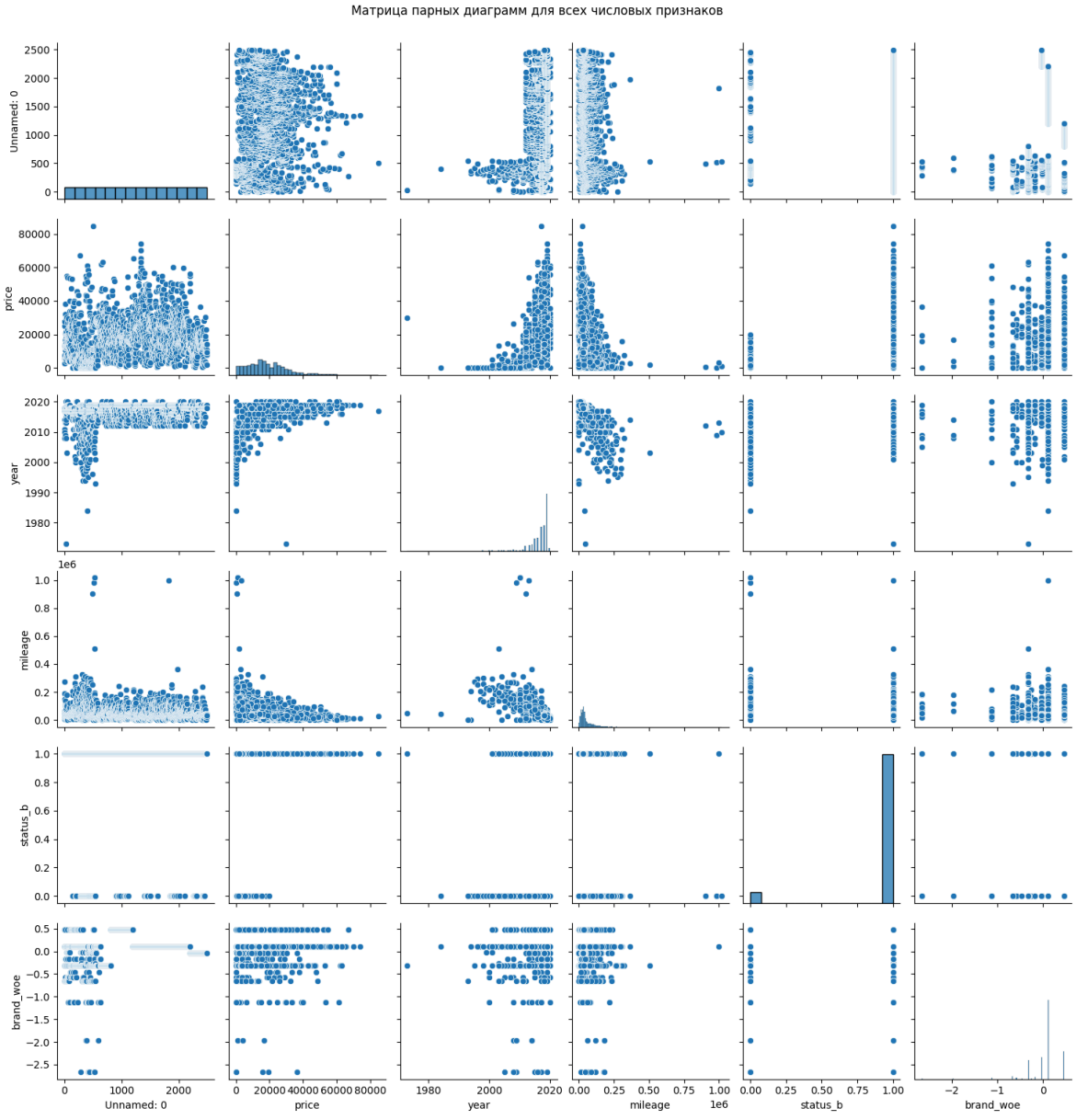
In [32]:
```
# Визуализация после обработки
plt.subplot(1, 2, 2)
plt.boxplot(data_upd['mileage'])
plt.show()
```



Дополнительное задание

Для студентов группы ИУ5-25М, ИУ5И-25М, ИУ5-25МВ - для произвольной колонки данных построить парные диаграммы (pairplot).

In [33]:
```
sns.pairplot(data)
plt.suptitle('Матрица парных диаграмм для всех числовых признаков', y=1.02)
plt.show()
```



In [ ]: