```
import numpy as np
import pandas as pd
```

```
df = pd.read_csv('smartphones.csv')
```

```
df.head()
```

	model	price	rating	sim	processor	ram	battery	display	camera	card	os
0	OnePlus 11 5G	₹54,999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen2, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	5000 mAh Battery with 100W Fast Charging	6.7 inches, 1440 x 3216 px, 120 Hz Display wit...	50 MP + 48 MP + 32 MP Triple Rear & 16 MP Fron...	Memory Card Not Supported	Android v13
1	OnePlus Nord CE 2 Lite 5G	₹19,989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 33W Fast Charging	6.59 inches, 1080 x 2412 px, 120 Hz Display wi...	64 MP + 2 MP + 2 MP Triple Rear & 16 MP Front ...	Memory Card (Hybrid), upto 1 TB	Android v12
2	Samsung Galaxy A14 5G	₹16,499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Exynos 1330, Octa Core, 2.4 GHz Processor	4 GB RAM, 64 GB inbuilt	5000 mAh Battery with 15W Fast Charging	6.6 inches, 1080 x 2408 px, 90 Hz Display with...	50 MP + 2 MP + 2 MP Triple Rear & 13 MP Front ...	Memory Card Supported, upto 1 TB	Android v13
3	Motorola Moto G62 5G	₹14,999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with Fast Charging	6.55 inches, 1080 x 2400 px, 120 Hz Display wi...	50 MP + 8 MP + 2 MP Triple Rear & 16 MP Front ...	Memory Card (Hybrid), upto 1 TB	Android v12

⌄ Data Assessing

Quality Issues

1. **model** - some brands are written diiferently like OPPO in model column `consistency`
2. **price** - has unneccesary '₹' `validity`
3. **price** - has ',' between numbers `validity`
4. **price** - phone Namotel has a price of 99 `accuracy`
5. **ratings** - missing values `completeness`
6. **processor** - has some incorrect values for some samsung phones(row #-642,647,649,659,667,701,750,759,819,859,883,884,919,927,929,932,1002) `validity`
7. There is ipod on row 756 `validity`
8. **memory** - incorrect values in rows (441,485,534,553,584,610,613,642,647,649,659,667,701,750,759,819,859,884,919,927,929,932,990,1002) `validity`
9. **battery** - incorrect values in rows(113,151,309,365,378,441,450,553,584,610,613,630,642,647,649,659,667,701,750,756,759,764,819,855,859,884,915,916,927,929,932,990,1002) `validity`
10. **display** - sometimes frequency is not available `completeness`
11. **display** - incorrect values in rows(378,441,450,553,584,610,613,630,642,647,649,659,667,701,750,759,764,819,859,884,915,916,927,929,932,990,1002) `validity`
12. certain phones are foldable and the info is scattered `validity`
13. **camera** - words like Dual, Triple and Quad are used to represent number of cameras and front and rear cameras are separated by '&'
14. **camera** - problem with rows (100,113,151,157,161,238,273,308,309,323,324,365,367,378,394,441,450,484,506,534,553,571,572,575,584,610,613,615,630,642,647,649,659,667,684,687,705,711,723,728,750,756,759,764,792,819,846,854,855,858,883,884,896,915,916,927,929,932,945,956,990,995,1002,1016) `validity`
15. **card** - sometimes contains info about os and camera `validity`
16. **os** - sometimes contains info about bluetooth and fm radio `validity`
17. **os** - issue with rows (324,378) `validity`
18. **os** - sometimes contains os version name like lollipop `consistency`
19. missing values in camera, card and os `completeness`
20. datatype of price and rating is incorrect `validity`

Tidiness Issues

1. **sim** - can be split into 3 cols has_5g, has_NFC, has_IR_Blaster
2. **ram** - can be split into 2 cols RAM and ROM
3. **processor** - can be split into processor name, cores and cpu speed.
4. **battery** - can be split into battery capacity, fast_charging_available

5. **display** - can be split into size, resolution_width, resolution_height and frequency
6. **camera** - can be split into front and rear camera
7. **card** - can be split into supported, extended_upto

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1020 entries, 0 to 1019
Data columns (total 11 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   model      1020 non-null   object
 1   price      1020 non-null   object
 2   rating     879 non-null    float64
 3   sim        1020 non-null   object
 4   processor  1020 non-null   object
 5   ram        1020 non-null   object
 6   battery    1020 non-null   object
 7   display    1020 non-null   object
 8   camera     1019 non-null   object
 9   card       1013 non-null   object
 10  os         1003 non-null   object
dtypes: float64(1), object(10)
memory usage: 87.8+ KB
```

```
df.describe()
```

	rating
count	879.000000
mean	78.258248
std	7.402854
min	60.000000
25%	74.000000
50%	80.000000
75%	84.000000
max	89.000000

```
df.duplicated().sum()
```

```
0
```

```
# make a copy
df1 = df.copy()
```

```
df1['price'] = df1['price'].str.replace('₹','').str.replace(',','').astype('int')
```

```
df1
```

	model	price	rating	sim	processor	ram	battery	display	camera
0	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen2, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	5000 mAh Battery with 100W Fast Charging	6.7 inches, 1440 x 3216 px, 120 Hz Display wit...	50 MP + 48 MP + 32 MP Triple Rear & 16 MP Fron...
1	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 33W Fast Charging	6.59 inches, 1080 x 2412 px, 120 Hz Display wi...	64 MP + 2 MP + 2 MP Triple Rear & 16 MP Front ...
2	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Exynos 1330, Octa Core, 2.4 GHz Processor	4 GB RAM, 64 GB inbuilt	5000 mAh Battery with 15W Fast Charging	6.6 inches, 1080 x 2408 px, 90 Hz Display with...	50 MP + 2 MP + 2 MP Triple Rear & 13 MP Front ...
3	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with Fast Charging	6.55 inches, 1080 x 2400 px, 120 Hz Display wi...	50 MP + 8 MP + 2 MP Triple Rear & 16 MP Front ...
4	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Dimensity 1080, Octa Core, 2.6 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 67W Fast Charging	6.7 inches, 1080 x 2412 px, 120 Hz Display wit...	108 MP + 8 MP + 2 MP Triple Rear & 16 MP Front...
...	...	...	...	...	...	...	...	...	...

```
df1 = df1.reset_index()

df1['index'] = df1['index'] + 2

df1
```

	index	model	price	rating	sim	processor	ram	battery	display	
0	2	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen2, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	5000 mAh Battery with 100W Fast Charging	6.7 inches, 1440 x 3216 px, 120 Hz Display wit...	5 4
1	3	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 33W Fast Charging	6.59 inches, 1080 x 2412 px, 120 Hz Display wi...	6
2	4	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Exynos 1330, Octa Core, 2.4 GHz Processor	4 GB RAM, 64 GB inbuilt	5000 mAh Battery with 15W Fast Charging	6.6 inches, 1080 x 2408 px, 90 Hz Display with...	5
3	5	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with Fast Charging	6.55 inches, 1080 x 2400 px, 120 Hz Display wi...	5
4	6	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Dimensity 1080, Octa Core, 2.6 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 67W Fast Charging	6.7 inches, 1080 x 2412 px, 120 Hz Display wit...	6
...	...	...	...	...	...	...	...	...	...	
					Dual			5000	6.67	6

```python
processor_rows = set((642,647,649,659,667,701,750,759,819,859,883,884,919,927,929,932,1002))
ram_rows = set((441,485,534,553,584,610,613,642,647,649,659,667,701,750,759,819,859,884,919,927,929,932,990,1002))
battery_rows = set((113,151,309,365,378,441,450,553,584,610,613,630,642,647,649,659,667,701,750,756,759,764,819,855,859,884,
display_rows = set((378,441,450,553,584,610,613,630,642,647,649,659,667,701,750,759,764,819,859,884,915,916,927,929,932,990,
camera_rows = set((100,113,151,157,161,238,273,308,309,323,324,365,367,378,394,441,450,484,506,534,553,571,572,575,584,610,6

df1[df1['index'].isin(processor_rows | ram_rows | battery_rows | display_rows | camera_rows)]
```

	index	model	price	rating	sim	processor	ram	battery	display
98	100	Vivo X Fold 5G	106990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen1, Octa Core, 3 GHz Processor	12 GB RAM, 256 GB inbuilt	4600 mAh Battery with 66W Fast Charging	8.03 inches, 1916 x 2160 px, 120 Hz Display
111	113	Apple iPhone 12	51999	74.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 64 GB inbuilt	6.1 inches, 1170 x 2532 px Display with Large ...	12 MP + 12 MP Dual Rear & 12 MP Front Camera
149	151	Apple iPhone 12 Mini	40999	74.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 64 GB inbuilt	5.4 inches, 1080 x 2340 px Display	12 MP + 12 MP Dual Rear & 12 MP Front Camera
155	157	Nokia 2780 Flip	4990	NaN	Dual Sim, 3G, 4G, Wi-Fi	Snapdragon QM215, Quad Core, 1.3 GHz Processor	4 GB RAM, 512 MB inbuilt	1450 mAh Battery	2.7 inches, 240 x 320 px Display
159	161	Oppo Find N2 5G	94990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8+ Gen1, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	4520 mAh Battery with 67W Fast Charging	7.1 inches, 1792 x 1920 px, 120 Hz Display wit...
...	...	...	...	...	...	...	...	...	...

```
df1[df1['index'].isin(processor_rows & ram_rows & battery_rows & display_rows & camera_rows)]
```

	index	model	price	rating	sim	processor	ram	battery	displ
640	642	Nokia 105 Plus	1299	NaN	Dual Sim	4 MB RAM, 4 MB inbuilt	800 mAh Battery	1.77 inches, 128 x 160 px Display	No R Cam
645	647	Nokia 2760 Flip	5490	NaN	Dual Sim, 3G, 4G, Wi-Fi	1450 mAh Battery	3.6 inches, 240 x 320 px Display	5 MP Rear & 5 MP Front Camera	Mem C Support upto
647	649	Motorola Moto A10	1339	NaN	Dual Sim	4 MB RAM, 4 MB inbuilt	1750 mAh Battery	1.8 inches, 160 x 128 px Display	No R Cam
657	659	Zanco Tiny T1	2799	NaN	Single Sim	32 MB RAM, 32 MB inbuilt	200 mAh Battery	0.49 inches, 64 x 32 px Display	No R Cam
665	667	itel it2163S	958	NaN	Dual Sim	4 MB RAM, 4 MB inbuilt	1200 mAh Battery	1.8 inches, 160 x 128 px Display	No R Cam
748	750	Nokia 400 4G	3290	NaN	Dual Sim, 4G, VoLTE, Wi-Fi	2000 mAh Battery	2.4 inches, 240 x 320 px Display	0.3 MP Rear & 0.3 MP Front Camera	Mem C Support upto
757	759	Karbonn KU3i	995	NaN	Dual Sim	52 MB RAM, 32 MB inbuilt	1000 mAh Battery	1.8 inches, 128 x 160 px Display	No R Cam
817	819	itel Magic X	2239	NaN	Dual Sim, 3G, 4G, VoLTE, Wi-Fi	No 3G	T117	48 MB RAM, 128 MB inbuilt	1200 m Batt

```
df1 = df1[df1['price'] >= 3400]
```

```
df1
```

	index	model	price	rating	sim	processor	ram	battery	display	
0	2	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen2, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	5000 mAh Battery with 100W Fast Charging	6.7 inches, 1440 x 3216 px, 120 Hz Display wit...	5 4
1	3	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 33W Fast Charging	6.59 inches, 1080 x 2412 px, 120 Hz Display wi...	6
2	4	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Exynos 1330, Octa Core, 2.4 GHz Processor	4 GB RAM, 64 GB inbuilt	5000 mAh Battery with 15W Fast Charging	6.6 inches, 1080 x 2408 px, 90 Hz Display with...	5
3	5	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with Fast Charging	6.55 inches, 1080 x 2400 px, 120 Hz Display wi...	5
4	6	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Dimensity 1080, Octa Core, 2.6 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 67W Fast Charging	6.7 inches, 1080 x 2412 px, 120 Hz Display wit...	6
...	...	...	...	...	...	...	...	...	...	
					Dual			5000	6.67	6

```
df1[df1['index'].isin(processor_rows)]
```

	index	model	price	rating	sim	processor	ram	battery	display	
645	647	Nokia 2760 Flip	5490	NaN	Dual Sim, 3G, 4G, Wi-Fi	1450 mAh Battery	3.6 inches, 240 x 320 px Display	5 MP Rear & 5 MP Front Camera	Memo Ca Supporte upto 3 G	
857	859	LG Folder 2	11999	NaN	Single Sim, 3G, 4G, Wi-Fi	1 GB RAM, 8 GB inbuilt	1470 mAh Battery	2.8 inches, 240 x 320 px Display	2 MP Re Came	
882	884	Nokia 5710	4799	NaN	Dual Sim, 3G	No Wifi	Unisoc T107	48 MB RAM,	1450 mA	

```
df1.drop([645,857,882,925],inplace=True)
```

```
df1[df1['index'].isin(ram_rows)]
```

	index	model	price	rating	sim	processor	ram	battery	display	
439	441	Apple iPhone SE 3 2022	43900	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A15, Hexa Core, 3.22 GHz Processor	64 GB inbuilt	4.7 inches, 750 x 1334 px Display	12 MP Rear & 7 MP Front Camera	S
		Huawei			Dual Sim, 3G,	Snapdragon		4700	6.74	

```python
df1.drop(582,inplace=True)
```

```python
df1[df1['index'].isin(battery_rows)]
```

	index	model	price	rating	sim	processor	ram	battery	display	
111	113	Apple iPhone 12	51999	74.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 64 GB inbuilt	6.1 inches, 1170 x 2532 px Display with Large ...	12 MP + 12 MP Dual Rear & 12 MP Front Camera	S
149	151	Apple iPhone 12 Mini	40999	74.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 64 GB inbuilt	5.4 inches, 1080 x 2340 px Display	12 MP + 12 MP Dual Rear & 12 MP Front Camera	S
307	309	Apple iPhone 12 (128GB)	55999	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 128 GB inbuilt	6.1 inches, 1170 x 2532 px Display with Large ...	12 MP + 12 MP Dual Rear & 12 MP Front Camera	S
363	365	Apple iPhone 12 Mini (128GB)	45999	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 128 GB inbuilt	5.4 inches, 1080 x 2340 px Display	12 MP + 12 MP Dual Rear & 12 MP Front Camera	S
376	378	Nokia 2660 Flip	4649	NaN	Dual Sim, 3G, 4G	No Wifi	Unisoc T107	48 MB RAM, 128 MB inbuilt	1450 mAh Battery	F
439	441	Apple iPhone SE 3 2022	43900	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A15, Hexa Core, 3.22 GHz Processor	64 GB inbuilt	4.7 inches, 750 x 1334 px Display	12 MP Rear & 7 MP Front Camera	S

```python
df1.drop([376,754],inplace=True)
```

```python
temp_df = df1[df1['index'].isin(battery_rows)]
```

```
x = temp_df.iloc[:,7:].shift(1,axis=1).values
```

```
df1.loc[temp_df.index,temp_df.columns[7:]] = x
```

```
df1[df1['index'].isin(display_rows)]
```

	index	model	price	rating	sim	processor	ram	battery	display	ca
439	441	Apple iPhone SE 3 2022	43900	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A15, Hexa Core, 3.22 GHz Processor	64 GB inbuilt	NaN	4.7 inches, 750 x 1334 px Display	F C:
448	450	Apple iPhone 15 Pro	130990	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A16	8 GB RAM, 128 GB inbuilt	NaN	6.06 inches, 1170 x 2532 px, 120 Hz Display wi...	5C 12 F F
628	630	Apple iPhone 12 Pro (512GB)	139900	80.0	Dual Sim, 3G, 4G, 5G, VoLTE	Bionic A14, Hexa Core, 3.1 GHz Processor	6 GB RAM, 512 GB	NaN	6.1 inches, 1170 x 2532 px Display	12 12 F

```
len(display_rows)
```

```
27
```

```
len(camera_rows)
```

```
64
```

```
df1[df1['index'].isin(camera_rows)]
# 155 271
```

	index	model	price	rating	sim	processor	ram	battery	display	camera	card	os
98	100	Vivo X Fold 5G	106990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen1, Octa Core, 3 GHz Processor	12 GB RAM, 256 GB inbuilt	4600 mAh Battery with 66W Fast Charging	8.03 inches, 1916 x 2160 px, 120 Hz Display	Foldable Display	50 MP Quad Rear & 16 MP Front Camera	Android v12
111	113	Apple iPhone 12	51999	74.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 64 GB inbuilt	NaN	6.1 inches, 1170 x 2532 px Display with Large ...	12 MP + 12 MP Dual Rear & 12 MP Front Camera	Memory Card Not Supported	iOS v14
149	151	Apple iPhone 12 Mini	40999	74.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A14, Hexa Core, 3.1 GHz Processor	4 GB RAM, 64 GB inbuilt	NaN	5.4 inches, 1080 x 2340 px Display	12 MP + 12 MP Dual Rear & 12 MP Front Camera	Memory Card Not Supported	iOS v14
155	157	Nokia 2780 Flip	4990	NaN	Dual Sim, 3G, 4G, Wi-Fi	Snapdragon QM215, Quad Core, 1.3 GHz Processor	4 GB RAM, 512 MB inbuilt	1450 mAh Battery	2.7 inches, 240 x 320 px Display	Dual Display	5 MP Rear Camera	Memory Card Supported, upto 32 GB
159	161	Oppo Find N2 5G	94990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8+ Gen1, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	4520 mAh Battery with 67W Fast Charging	7.1 inches, 1792 x 1920 px, 120 Hz Display wit...	Foldable Display, Dual Display	50 MP + 48 MP + 32 MP Triple Rear & 32 MP + 32...	Memory Card Not Supported
236	238	Xiaomi Mix Fold 2 5G	106990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC, IR Bl...	Snapdragon 8+ Gen1 , Octa Core, 3.2 GHz Proce...	12 GB RAM, 256 GB inbuilt	4500 mAh Battery with 67W Fast Charging	8.02 inches, 1914 x 2160 px, 120 Hz Display wi...	Foldable Display, Dual Display	50 MP + 13 MP + 8 MP Triple Rear & 20 MP Front...	Android v12
271	273	Nokia 2720 V Flip	6199	NaN	Dual Sim, 3G, 4G, VoLTE, Wi-Fi	Snapdragon 205 , Dual Core, 1.1 GHz Processor	512 MB RAM, 4 GB inbuilt	1500 mAh Battery	2.8 inches, 240 x 320 px Display	Dual Display	2 MP Rear Camera	Memory Card Supported
306	308	Samsung Galaxy Z Flip 3	69999	84.0	Single Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 888, Octa Core, 2.84 GHz Processor	8 GB RAM, 128 GB inbuilt	3300 mAh Battery with 15W Fast Charging	6.7 inches, 1080 x 2640 px, 120 Hz Display wit...	Foldable Display, Dual Display	12 MP + 12 MP Dual Rear & 10 MP Front Camera	Memory Card Not Supported
		Apple ... Fold 4			Dual Sim, 3G, 4G, Wi-Fi, NFC	Bionic A14, Processor ... Octa, 3.2 GHz	4 GB RAM inbuilt ... 12 GB GB	4400 mAh Fast	6.1 inches, 1170 x 2532 ... 7.6 inches, Display	12 MP + 12 MP Dual Camera ... Dual	Memory ... Triple Rear &	

```
df1.drop([155, 271],inplace=True)

temp_df = df1[df1['index'].isin(camera_rows)]

temp_df = temp_df[~temp_df['camera'].str.contains('MP')]

df1.loc[temp_df.index, 'camera'] = temp_df['card'].values

df1['card'].value_counts()
```

```
Memory Card Supported, upto 1 TB         171
Memory Card Not Supported                123
Android v12                              107
Memory Card Supported, upto 512 GB       105
Memory Card (Hybrid), upto 1 TB           91
Memory Card Supported                     89
Memory Card Supported, upto 256 GB        87
Android v13                               46
Android v11                               41
Memory Card (Hybrid)                      30
Memory Card (Hybrid), upto 256 GB         13
Android v10                               11
Memory Card (Hybrid), upto 512 GB         11
Memory Card Supported, upto 128 GB         6
Memory Card Supported, upto 2 TB           5
Memory Card Supported, upto 32 GB          4
Memory Card (Hybrid), upto 64 GB           3
```

```
    Memory Card (Hybrid), upto 128 GB                                  3
    Android v9.0 (Pie)                                                 2
    50 MP + 12 MP + 10 MP Triple Rear & 10 MP + 4 MP Dual Front Camera 2
    64 MP + 16 MP + 8 MP Triple Rear & 32 MP Front Camera              2
    50 MP + 8 MP Dual Rear & 32 MP Front Camera                        2
    12 MP + 12 MP Dual Rear & 10 MP Front Camera                       2
    50 MP Quad Rear & 16 MP Front Camera                               2
    64 MP + 13 MP + 0.3 MP Triple Rear & 10 MP Front Camera            1
    48 MP Quad Rear Camera                                             1
    HarmonyOS                                                          1
    Memory Card (Hybrid), upto 2 TB                                    1
    5 MP Rear & 2 MP Front Camera                                      1
    108 MP + 13 MP + 8 MP Triple Rear & 20 MP Front Camera             1
    HarmonyOS v2.0                                                     1
    50 MP + 13 MP + 8 MP Triple Rear & 10.7 MP Front Camera            1
    50 MP + 13 MP + 5 MP Triple Rear & 12 MP Front Camera              1
    64 MP + 16 MP + 12 MP Triple Rear & 16 MP Front Camera             1
    50 MP + 16 MP + 13 MP Triple Rear & 32 MP Front Camera             1
    iOS v13                                                            1
    50 MP + 13 MP + 8 MP Triple Rear & 20 MP Front Camera              1
    Android v10.0                                                      1
    64 MP + 20 MP + 2 MP Triple Rear & Main Front Camera               1
    iOS v10                                                            1
    64 MP + 13 MP + 12 MP Triple Rear & 32 MP Front Camera             1
    12 MP + 12 MP + 12 MP Triple Rear & 10 MP + 4 MP Dual Front Camera 1
    Memory Card Supported, upto 1000 GB                                1
    50 MP Quad Rear & 16 MP + 16 MP Dual Front Camera                  1
    64 MP + 10 MP + 8 MP Triple Rear & 32 MP Front Camera              1
    Android v12.1                                                      1
    50 MP + 48 MP + 32 MP Triple Rear & 32 MP + 32 MP Dual Front Camera 1
    50 MP + 50 MP + 10 MP Triple Rear & 32 MP Front Camera             1
    Name: card, dtype: int64
```

```python
temp_df = df1[df1['card'].str.contains('MP')]
```

```python
df1.loc[temp_df.index,'card'] = 'Memory Card Not Supported'
```

```python
df1['card'].value_counts()
```

```
    Memory Card Supported, upto 1 TB      171
    Memory Card Not Supported             149
    Android v12                           107
    Memory Card Supported, upto 512 GB    105
    Memory Card (Hybrid), upto 1 TB        91
    Memory Card Supported                  89
    Memory Card Supported, upto 256 GB     87
    Android v13                            46
    Android v11                            41
    Memory Card (Hybrid)                   30
    Memory Card (Hybrid), upto 256 GB      13
    Memory Card (Hybrid), upto 512 GB      11
    Android v10                            11
    Memory Card Supported, upto 128 GB      6
    Memory Card Supported, upto 2 TB        5
    Memory Card Supported, upto 32 GB       4
    Memory Card (Hybrid), upto 64 GB        3
    Memory Card (Hybrid), upto 128 GB       3
    Android v9.0 (Pie)                      2
    Android v12.1                           1
    Memory Card Supported, upto 1000 GB     1
    iOS v10                                 1
    Android v10.0                           1
    iOS v13                                 1
    HarmonyOS v2.0                          1
    Memory Card (Hybrid), upto 2 TB         1
    HarmonyOS                               1
    Name: card, dtype: int64
```

```python
pd.set_option('display.max_rows', None)
```

```python
temp_df = df1[~df1['card'].str.contains('Memory Card')]
```

```python
df1.loc[temp_df.index,'os'] = temp_df['card'].values
```

```python
df1.loc[temp_df.index,'card'] = 'Memory Card Not Supported'
```

```python
df1['card'].value_counts()
```

```
    Memory Card Not Supported             362
    Memory Card Supported, upto 1 TB      171
    Memory Card Supported, upto 512 GB    105
    Memory Card (Hybrid), upto 1 TB        91
```

```
        Memory Card Supported                    89
        Memory Card Supported, upto 256 GB       87
        Memory Card (Hybrid)                     30
        Memory Card (Hybrid), upto 256 GB        13
        Memory Card (Hybrid), upto 512 GB        11
        Memory Card Supported, upto 128 GB        6
        Memory Card Supported, upto 2 TB          5
        Memory Card Supported, upto 32 GB         4
        Memory Card (Hybrid), upto 128 GB         3
        Memory Card (Hybrid), upto 64 GB          3
        Memory Card Supported, upto 1000 GB       1
        Memory Card (Hybrid), upto 2 TB           1
        Name: card, dtype: int64
```

```
df1['os'].value_counts()
```

```
        Android v12                           394
        Android v11                           274
        Android v13                            91
        Android v10                            69
        Android v9.0 (Pie)                     29
        Android v10.0                          23
        iOS v16                                15
        iOS v15                                12
        Android v8.1 (Oreo)                    10
        iOS v14                                 6
        Memory Card Not Supported               6
        Android v11.0                           4
        Android v8.0 (Oreo)                     4
        iOS v13                                 4
        iOS v15.0                               3
        Android v6.0 (Marshmallow)              2
        Memory Card (Hybrid), upto 256 GB       2
        Memory Card (Hybrid), upto 2 TB         2
        HarmonyOS v2.0                          2
        Android v5.1.1 (Lollipop)               2
        Harmony v2.0                            2
        EMUI v12                                2
        Memory Card Supported, upto 256 GB      2
        Android v12.1                           2
        iOS v14.0                               2
        Memory Card Supported, upto 128 GB      1
        Android v7.1 (Nougat)                   1
        Android                                 1
        Hongmeng OS v4.0                        1
        HarmonyOS                               1
        Android v5.1 (Lollipop)                 1
        RTOS (Series 30+)                       1
        Memory Card (Hybrid)                    1
        iOS v10                                 1
        Pragati OS (Powered by Android)         1
        Bluetooth                               1
        Hongmeng OS v3.0                        1
        Android v4.4.2 (KitKat)                 1
        iOS v17                                 1
        iOS v12.3                               1
        iOS v13.0                               1
        HarmonyOS v2                            1
        Android v9 (Pie)                        1
        Name: os, dtype: int64
```

```
temp_df = df1[df1['os'] == 'Bluetooth']
```

```
df1.loc[temp_df.index,'os'] = np.nan
```

```
df1.head()
```

	index	model	price	rating	sim	processor	ram	battery	display	came
0	2	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen2, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	5000 mAh Battery with 100W Fast Charging	6.7 inches, 1440 x 3216 px, 120 Hz Display wit...	50 M 48 M 32 Tr Rea 16 Fro
1	3	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 33W Fast Charging	6.59 inches, 1080 x 2412 px, 120 Hz Display wi...	64 M 2 M 2 Tr Rea 16 Fro
		Samsung			Dual Sim, 3G	Exynos 1330, Octa	4 GB RAM	5000 mAh	6.6 inches, 1080 x	50 M 2 M 2

```
df1['display'].value_counts()
```

```
6.67 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole           54
6.5 inches, 720 x 1600 px Display with Water Drop Notch               36
6.7 inches, 1080 x 2412 px, 120 Hz Display with Punch Hole            25
6.52 inches, 720 x 1600 px Display with Water Drop Notch              23
6.5 inches, 1080 x 2400 px, 90 Hz Display with Punch Hole             22
6.51 inches, 720 x 1600 px Display with Water Drop Notch              21
6.43 inches, 1080 x 2400 px, 90 Hz Display with Punch Hole            19
6.43 inches, 1080 x 2400 px Display with Punch Hole                   16
6.62 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole           15
6.53 inches, 720 x 1600 px Display with Water Drop Notch              14
6.4 inches, 1080 x 2400 px, 90 Hz Display with Punch Hole             14
6.55 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole           11
6.7 inches, 1440 x 3216 px, 120 Hz Display with Punch Hole            10
6.58 inches, 1080 x 2408 px, 120 Hz Display with Water Drop Notch     10
6.5 inches, 720 x 1600 px, 90 Hz Display with Water Drop Notch        10
6.6 inches, 1080 x 2400 px, 90 Hz Display with Punch Hole             10
6.7 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole            10
6.5 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole            10
6.67 inches, 1080 x 2400 px Display with Punch Hole                    9
6.6 inches, 1080 x 2408 px Display with Water Drop Notch               9
6.55 inches, 1080 x 2400 px, 90 Hz Display with Punch Hole             9
6.6 inches, 1080 x 2408 px, 90 Hz Display with Water Drop Notch        9
6.78 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole            9
6.7 inches, 1080 x 2400 px Display with Punch Hole                     8
6.58 inches, 1080 x 2408 px, 90 Hz Display with Water Drop Notch       8
6.5 inches, 720 x 1600 px, 90 Hz Display with Punch Hole               7
6.59 inches, 1080 x 2412 px, 120 Hz Display with Punch Hole            7
6.6 inches, 1080 x 2408 px, 120 Hz Display with Water Drop Notch       7
6.53 inches, 1080 x 2340 px Display with Water Drop Notch              7
6.6 inches, 1080 x 2412 px, 120 Hz Display with Punch Hole             7
6.58 inches, 1080 x 2400 px, 90 Hz Display with Water Drop Notch       7
6.58 inches, 1080 x 2408 px Display with Water Drop Notch              7
6.67 inches, 1080 x 2400 px, 144 Hz Display with Punch Hole            7
6.1 inches, 1170 x 2532 px Display with Small Notch                    6
6.73 inches, 1440 x 3200 px, 120 Hz Display with Punch Hole            6
6.4 inches, 1080 x 2400 px, 90 Hz Display with Water Drop Notch        6
6.44 inches, 1080 x 2400 px Display with Water Drop Notch              6
6.1 inches, 1170 x 2532 px Display with Large Notch                    5
6.6 inches, 1080 x 2460 px, 144 Hz Display with Punch Hole             5
6.5 inches, 720 x 1560 px Display with Water Drop Notch                5
6.4 inches, 1080 x 2340 px Display with Water Drop Notch               5
6.4 inches, 1080 x 2400 px Display with Punch Hole                     5
6.67 inches, 1440 x 3200 px, 120 Hz Display with Punch Hole            5
6.8 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole             5
6.44 inches, 1080 x 2404 px, 90 Hz Display with Water Drop Notch       5
6.56 inches, 720 x 1612 px, 90 Hz Display with Water Drop Notch        5
6.67 inches, 1080 x 2460 px, 120 Hz Display with Punch Hole            5
6.56 inches, 720 x 1612 px Display with Water Drop Notch               5
6.6 inches, 720 x 1612 px, 90 Hz Display with Water Drop Notch         4
6.6 inches, 1080 x 2400 px, 120 Hz Display with Punch Hole             4
6.7 inches, 720 x 1600 px Display with Water Drop Notch                4
6.7 inches, 1290 x 2796 px, 120 Hz Display                             4
6.56 inches, 1080 x 2376 px, 120 Hz Display with Punch Hole            4
6.67 inches, 2400 x 1080 px, 120 Hz Display with Punch Hole            4
6.5 inches, 1600 x 720 px Display with Water Drop Notch                4
6.56 inches, 720 x 1600 px Display with Water Drop Notch               4
6.7 inches, 1080 x 2400 px Display with Water Drop Notch               4
```

6.35 inches, 720 x 1544 px Display with Water Drop Notch   4

```
(982/1020)*100
```

96.27450980392157

df1

	index	model	price	rating	sim	processor	ram	battery	display	camera	card	os
0	2	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 8 Gen2, Octa Core, 3.2 GHz Processor	12 GB RAM, 256 GB inbuilt	5000 mAh Battery with 100W Fast Charging	6.7 inches, 1440 x 3216 px, 120 Hz Display wit...	50 MP + 48 MP + 32 MP Triple Rear & 16 MP Fron...	Memory Card Not Supported	Android v13
1	3	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 33W Fast Charging	6.59 inches, 1080 x 2412 px, 120 Hz Display wi...	64 MP + 2 MP + 2 MP Triple Rear & 16 MP Front ...	Memory Card (Hybrid), upto 1 TB	Android v12
2	4	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Exynos 1330, Octa Core, 2.4 GHz Processor	4 GB RAM, 64 GB inbuilt	5000 mAh Battery with 15W Fast Charging	6.6 inches, 1080 x 2408 px, 90 Hz Display with...	50 MP + 2 MP + 2 MP Triple Rear & 13 MP Front ...	Memory Card Supported, upto 1 TB	Android v13
3	5	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Snapdragon 695, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with Fast Charging	6.55 inches, 1080 x 2400 px, 120 Hz Display wi...	50 MP + 8 MP + 2 MP Triple Rear & 16 MP Front ...	Memory Card (Hybrid), upto 1 TB	Android v12
4	6	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	Dimensity 1080, Octa Core, 2.6 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 67W Fast Charging	6.7 inches, 1080 x 2412 px, 120 Hz Display wit...	108 MP + 8 MP + 2 MP Triple Rear & 16 MP Front...	Memory Card Not Supported	Android v13
5	7	Samsung Galaxy F23 5G (6GB RAM + 128GB)	16999	80.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Snapdragon 750G, Octa Core, 2.2 GHz Processor	6 GB RAM, 128 GB inbuilt	5000 mAh Battery with 25W Fast Charging	6.6 inches, 1080 x 2408 px, 120 Hz Display wit...	50 MP + 8 MP + 2 MP Triple Rear & 8 MP Front C...	Memory Card Supported, upto 1 TB	Android v12
6	8	Apple iPhone 14	65999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	Bionic A15, Hexa Core, 3.22 GHz Processor	6 GB RAM, 128 GB inbuilt	3279 mAh Battery with Fast Charging	6.1 inches, 1170 x 2532 px Display with Small ...	12 MP + 12 MP Dual Rear & 12 MP Front Camera	Memory Card Not Supported	iOS v16
7	9	Xiaomi Redmi Note 12 Pro Plus	29999	86.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, IR Blaster	Dimensity 1080, Octa Core, 2.6 GHz Processor	8 GB RAM, 256 GB inbuilt	4980 mAh Battery with 120W Fast Charging	6.67 inches, 1080 x 2400 px, 120 Hz Display	200 MP + 8 MP + 2 MP Triple Rear & 16 MP Front	Memory Card Not Supported	Android v12

df1.info()

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 982 entries, 0 to 1019
Data columns (total 12 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   index      982 non-null    int64
 1   model      982 non-null    object
 2   price      982 non-null    int64
 3   rating     879 non-null    float64
 4   sim        982 non-null    object
 5   processor  982 non-null    object
 6   ram        982 non-null    object
 7   battery    971 non-null    object
 8   display    982 non-null    object
 9   camera     982 non-null    object
 10  card       982 non-null    object
 11  os         981 non-null    object
dtypes: float64(1), int64(2), object(9)
memory usage: 132.0+ KB
```

Wi-Fi   Processor   inbuilt   Charging   Display   Camera   upto 1 TB

```python
brand_names = df1['model'].str.split(' ').str.get(0)
```

```python
df1.insert(1,'brand_name',brand_names)
```

```python
df1['brand_name'] = df1['brand_name'].str.lower()
```

```python
has_5g = df1['sim'].str.contains('5G')
has_nfc = df1['sim'].str.contains('NFC')
has_ir_blaster = df1['sim'].str.contains('IR Blaster')
```

```python
df1.insert(6,'has_5g',has_5g)
df1.insert(7,'has_nfc',has_nfc)
df1.insert(8,'has_ir_blaster',has_ir_blaster)
```

```python
processor_name = df1['processor'].str.split(',').str.get(0)
```

```python
num_cores = df1['processor'].str.split(',').str.get(1)
```

```python
processor_speed = df1['processor'].str.split(',').str.get(2)
```

```python
df1.insert(10,'processor_name',processor_name)
df1.insert(11,'num_cores',num_cores)
df1.insert(12,'processor_speed',processor_speed)
```

```python
df1['processor_name'] = df1['processor_name'].str.strip()
```

```python
temp_df = df1[df1['processor_name'].str.contains('Core')][['processor_name', 'num_cores',   'processor_speed']].shift(1,axis
```

```python
temp_df.shape
```

```
(20, 3)
```

```python
df1.loc[temp_df.index,['processor_name', 'num_cores',   'processor_speed']] = temp_df.values
```

```python
df1.loc[856]
```

```
index                                     858
brand_name                            samsung
model                   Samsung Galaxy A01 Core
price                                    4999
rating                                    NaN
sim                    Dual Sim, 3G, 4G, VoLTE, Wi-Fi
has_5g                                  False
has_nfc                                 False
has_ir_blaster                          False
processor              (28 nm), Quad Core, 1.5 GHz Processor
processor_name                        (28 nm)
num_cores                           Quad Core
processor_speed                1.5 GHz Processor
ram                    1 GB RAM, 16 GB inbuilt
battery                       3000 mAh Battery
display                5.3 inches, 720 x 1480 px Display
camera                 8 MP Rear & 5 MP Front Camera
card                      Memory Card Supported
os                               Android v10
Name: 856, dtype: object
```

```python
df1.loc[856,'processor_name'] = 'Mediatek MT6739'
```

```python
processor_brand = df1['processor_name'].str.split(' ').str.get(0).str.lower()
```

```python
df1.insert(11,'processor_brand',processor_brand)
```

```python
df1['num_cores'] = df1['num_cores'].str.strip()
```

```python
df1['num_cores'] = df1['num_cores'].str.replace('Octa Core Processor','Octa Core').str.replace('Hexa Core Processor','Hexa (
```

```python
df1['processor_speed'] = df1['processor_speed'].str.strip().str.split(' ').str.get(0).str.replace('\u2009',' ').str.split('
```

```python
df1.head()
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_bl
0	2	oneplus	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
1	3	oneplus	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
2	4	samsung	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
3	5	motorola	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
4	6	realme	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	

```
ram_capacity = df1['ram'].str.strip().str.split(',').str.get(0).str.findall(r'\b(\d+)\b').str.get(0)

df1.insert(16,'ram_capacity',ram_capacity)

df1.head()
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_bl:
0	2	oneplus	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
1	3	oneplus	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
2	4	samsung	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
3	5	motorola	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
4	6	realme	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	

```
internal_memory = df1['ram'].str.strip().str.split(',').str.get(1).str.strip().str.findall(r'\b(\d+)\b').str.get(0)

df1.insert(17,'internal_memory',internal_memory)

df1['ram_capacity'] = df1['ram_capacity'].astype(float)

df1.drop([486,627],inplace=True)

df1.loc[[483], ['ram_capacity','internal_memory']] = [12.0,'512']

df1['ram_capacity'].value_counts()
```

```
8.0     339
6.0     234
4.0     215
12.0     86
3.0      54
2.0      32
16.0      9
1.0       7
18.0      2
64.0      2
Name: ram_capacity, dtype: int64
```

```
df1['internal_memory'] = df1['internal_memory'].astype(float)

temp_df = df1[df1['internal_memory'] == 1]

df1.loc[temp_df.index,'internal_memory'] = 1024
```

```python
df1['internal_memory'].value_counts()
```

```
128.0     523
64.0      191
256.0     157
32.0       67
512.0      22
16.0       12
1024.0      5
8.0         1
Name: internal_memory, dtype: int64
```

```python
battery_capacity = df1['battery'].str.strip().str.split('with').str.get(0).str.strip().str.findall(r'\b(\d+)\b').str.get(0).
```

```python
df1.insert(16,'battery_capacity',battery_capacity)
```

```python
fast_charging = df1['battery'].str.strip().str.split('with').str.get(1).str.strip().str.findall(r'\d{2,3}')
```

```python
df1.insert(17,'fast_charging',fast_charging)
```

```python
def fast_charging_extractor(item):

  if type(item) == list:
    if len(item) == 1:
      return item[0]
    else:
      return 0
  else:
    return -1
```

```python
df1['fast_charging'] = df1['fast_charging'].apply(fast_charging_extractor).astype(int)
```

```python
screen_size = df1['display'].str.strip().str.split(',').str.get(0).str.strip().str.split(' ').str.get(0).astype(float)
```

```python
df1.insert(21,'screen_size',screen_size)
```

```python
resolution = df1['display'].str.strip().str.split(',').str.get(1).str.strip().str.split('px').str.get(0)
```

```python
df1.insert(22,'resolution',resolution)
```

```python
refresh_rate = df1['display'].str.strip().str.split(',').str.get(2).str.strip().str.findall(r'\d{2,3}').str.get(0).apply(lam
```

```python
df1.insert(22,'refresh_rate',refresh_rate)
```

```python
df1.head()
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_bl
0	2	oneplus	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
1	3	oneplus	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
2	4	samsung	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
3	5	motorola	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
4	6	realme	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	

```python
def camera_extractor(text):

  if 'Quad' in text:
    return '4'
  elif 'Triple' in text:
    return '3'
  elif 'Dual' in text:
    return '2'
  elif 'Missing' in text:
    return 'Missing'
  else:
    return '1'

num_rear_cameras = df1['camera'].str.strip().str.split('&').str.get(0).apply(camera_extractor)

df1.insert(25,'num_rear_cameras',num_rear_cameras)

num_front_cameras = df1['camera'].str.strip().str.split('&').str.get(1).str.strip().fillna('Missing').apply(camera_extractor)

df1.insert(26,'num_front_cameras',num_front_cameras)

df1.head()
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_bl…
0	2	oneplus	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
1	3	oneplus	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
2	4	samsung	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
3	5	motorola	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
4	6	realme	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	

```
df1[df1['num_front_cameras'] == 'Missing']
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_l
69	71	oppo	Oppo Find N Fold	99990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
462	464	xiaomi	Xiaomi Mi Mix Alpha	199990	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
993	995	huawei	Huawei Mate X	169000	NaN	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC, IR Bl...	True	True	
1012	1014	itel	itel A23s	4787	NaN	Dual Sim, 3G, 4G, Wi-Fi	False	False	

```python
pd.set_option('display.max_columns',None)
df1.head()
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_bla
0	2	oneplus	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
1	3	oneplus	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
2	4	samsung	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
3	5	motorola	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
4	6	realme	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	

```python
#df1[df1['camera'] == 'Foldable Display, Dual Display']
df1.loc[69,'camera'] == '50 MP'
```

```
    False
```

```python
temp_df = df1[df1['camera'] == 'Foldable Display, Dual Display']

df1.loc[temp_df.index, 'camera'] = '50 MP'

df1['primary_camera_rear'] = df1['camera'].str.split(' ').str.get(0).str.replace('\u2009',' ').str.split(' ').str.get(0)

df1['primary_camera_front'] = df1['camera'].str.split('&').str.get(1).str.strip().str.split(' ').str.get(0).str.replace('\u2

df1.head()
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_bla
0	2	oneplus	OnePlus 11 5G	54999	89.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi, NFC	True	True	
1	3	oneplus	OnePlus Nord CE 2 Lite 5G	19989	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
2	4	samsung	Samsung Galaxy A14 5G	16499	75.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
3	5	motorola	Motorola Moto G62 5G	14999	81.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	False	
4	6	realme	Realme 10 Pro Plus	24999	82.0	Dual Sim, 3G, 4G, 5G	True	False	1080x Quad Card

```
df1[df1['card'] == 'Memory Card (Hybrid)']
```

	index	brand_name	model	price	rating	sim	has_5g	has_nfc	has_ir_blaster	processor	processor_name	processo
25	27	samsung	Samsung Galaxy S20 FE 5G	31239	88.0	Dual Sim, 3G, 4G, 5G, VoLTE, Wi-Fi	True	True	False	Snapdragon 865, Octa Core, 2.84 GHz Processor	Snapdragon 865	sn