CUSTOMER CHURN PREDICTION DATA ANALYTICS WITH COGNOS:GROUP2 PHASE:3

This phase involves in designing of the steps that defining in each phase of the previous documentation this involves importing necessary functions, data processing and so on in this phase we have to begin our project by loading and preprocessing the dataset.

The IBM suggests using the jupyter notebook for loading and preprocess the dataset:

Here for this project title we need to define the loading the libraries, understand the data and visualize the missing values.

For this certain inputs are defined for this project in this phase each of the input lines of the project is given as follows:

HEM NAAN MUDHULVAN PHASE3

phase3

October 17, 2023

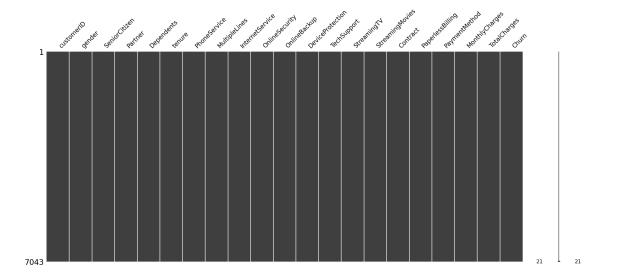
```
import pandas as pd
     import numpy as np
     import missingno as msno
[2]: df = pd.read_csv('WA_Fn-UseC_-Telco-Customer-Churn.csv')
[3]:
     df.head()
[3]:
        customerID
                     gender
                             SeniorCitizen Partner Dependents
                                                                  tenure PhoneService
        7590-VHVEG
                     Female
                                                 Yes
                                                                        1
                                           0
                                                              No
                                                                                    No
     1 5575-GNVDE
                       Male
                                           0
                                                  No
                                                              No
                                                                       34
                                                                                   Yes
        3668-QPYBK
                       Male
                                          0
                                                                        2
                                                                                   Yes
                                                  No
                                                              No
     3 7795-CFOCW
                       Male
                                           0
                                                  No
                                                              No
                                                                       45
                                                                                    No
     4 9237-HQITU Female
                                           0
                                                  No
                                                              No
                                                                        2
                                                                                   Yes
           MultipleLines InternetService OnlineSecurity
                                                             ... DeviceProtection
     0
        No phone service
                                       DSL
                                                         No
                                                                              No
     1
                                       DSL
                                                                             Yes
                       No
                                                        Yes
     2
                       No
                                       DSL
                                                                              No
                                                        Yes
     3
                                       DSL
        No phone service
                                                        Yes
                                                                             Yes
                               Fiber optic
                                                         No
                                                                              No
                       No
       TechSupport StreamingTV StreamingMovies
                                                         Contract PaperlessBilling
     0
                 No
                              No
                                                   Month-to-month
                                                                                 Yes
                                               No
     1
                 No
                              No
                                                                                  No
                                               No
                                                          One year
     2
                                                                                 Yes
                 No
                              No
                                               No
                                                   Month-to-month
                             No
     3
                Yes
                                               No
                                                          One year
                                                                                  No
     4
                 No
                                               No
                                                   Month-to-month
                                                                                 Yes
                     PaymentMethod MonthlyCharges
                                                     TotalCharges Churn
     0
                  Electronic check
                                              29.85
                                                             29.85
                                                                      No
     1
                      Mailed check
                                              56.95
                                                            1889.5
                                                                      No
     2
                      Mailed check
                                              53.85
                                                            108.15
                                                                     Yes
     3
        Bank transfer (automatic)
                                              42.30
                                                           1840.75
                                                                      No
     4
                  Electronic check
                                              70.70
                                                            151.65
                                                                     Yes
```

[5 rows x 21 columns]

```
[4]: df.shape
[4]: (7043, 21)
[5]: df.info()
    <class 'pandas.core.frame.DataFrame'>
    RangeIndex: 7043 entries, 0 to 7042
    Data columns (total 21 columns):
         Column
                            Non-Null Count
                                            Dtype
         _____
     0
         customerID
                            7043 non-null
                                             object
     1
         gender
                            7043 non-null
                                             object
     2
         SeniorCitizen
                            7043 non-null
                                             int64
     3
         Partner
                            7043 non-null
                                             object
     4
         Dependents
                            7043 non-null
                                            object
     5
         tenure
                            7043 non-null
                                             int64
     6
         PhoneService
                            7043 non-null
                                             object
     7
                            7043 non-null
         MultipleLines
                                             object
     8
         InternetService
                            7043 non-null
                                            object
     9
         OnlineSecurity
                            7043 non-null
                                             object
     10
         OnlineBackup
                            7043 non-null
                                             object
     11
        DeviceProtection
                           7043 non-null
                                            object
         TechSupport
                            7043 non-null
                                             object
         StreamingTV
                            7043 non-null
                                            object
         StreamingMovies
                            7043 non-null
                                            object
         Contract
                            7043 non-null
                                            object
     16
        PaperlessBilling
                            7043 non-null
                                             object
     17
         PaymentMethod
                            7043 non-null
                                             object
                            7043 non-null
     18
         MonthlyCharges
                                            float64
     19
         TotalCharges
                            7043 non-null
                                             object
     20
         Churn
                            7043 non-null
                                             object
    dtypes: float64(1), int64(2), object(18)
    memory usage: 1.1+ MB
[6]: df.columns.values
[6]: array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
            'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
            'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
            'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
            'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
            'TotalCharges', 'Churn'], dtype=object)
[7]: df.dtypes
```

[7]: customerID object object gender SeniorCitizen int64 Partner object Dependents object tenure int64 PhoneService object MultipleLines object InternetService object OnlineSecurity object OnlineBackup object DeviceProtection object TechSupport object ${\tt StreamingTV}$ object StreamingMovies object Contract object PaperlessBilling object PaymentMethod object MonthlyCharges float64 TotalCharges object Churn object dtype: object

[8]: msno.matrix(df);



```
[9]: df = df.drop(['customerID'], axis = 1)
    df.head()
```

```
[9]:
         gender
                 SeniorCitizen Partner Dependents tenure PhoneService \
         Female
                                     Yes
                                                           1
                              0
                                                  No
                                                                        Nο
           Male
                              0
                                                          34
      1
                                      Nο
                                                  Nο
                                                                       Yes
      2
           Male
                              0
                                      No
                                                 No
                                                           2
                                                                       Yes
           Male
      3
                              0
                                      No
                                                 No
                                                          45
                                                                        No
      4 Female
                                      No
                                                  No
                                                           2
                                                                       Yes
            MultipleLines InternetService OnlineSecurity OnlineBackup
         No phone service
                                        DSL
                                                         No
                                                                      Yes
      0
                                        DSL
                                                        Yes
                                                                       No
      1
      2
                                        DSL
                                                        Yes
                                                                      Yes
                        No
      3
        No phone service
                                        DSL
                                                        Yes
                                                                       No
                        No
                               Fiber optic
                                                         No
                                                                       No
        DeviceProtection TechSupport StreamingTV StreamingMovies
                                                                            Contract
      0
                                    No
                                                No
                                                                      Month-to-month
      1
                      Yes
                                    Nο
                                                Nο
                                                                 No
                                                                            One year
      2
                       No
                                    No
                                                No
                                                                 No
                                                                     Month-to-month
      3
                      Yes
                                   Yes
                                                No
                                                                 No
                                                                            One year
      4
                       No
                                    No
                                                No
                                                                 No
                                                                     Month-to-month
        PaperlessBilling
                                        PaymentMethod MonthlyCharges TotalCharges \
                                                                 29.85
                      Yes
                                     Electronic check
                                                                               29.85
      0
                                                                  56.95
                       No
                                         Mailed check
                                                                              1889.5
      1
      2
                      Yes
                                         Mailed check
                                                                 53.85
                                                                              108.15
      3
                       No
                          Bank transfer (automatic)
                                                                 42.30
                                                                             1840.75
      4
                                     Electronic check
                                                                 70.70
                      Yes
                                                                              151.65
        Churn
      0
           No
      1
           No
      2
          Yes
      3
           No
      4
          Yes
[10]: df['TotalCharges'] = pd.to_numeric(df.TotalCharges, errors='coerce')
      df.isnull().sum()
[10]: gender
                            0
      SeniorCitizen
                            0
                            0
      Partner
      Dependents
                            0
      tenure
                            0
                            0
      PhoneService
      MultipleLines
                            0
      InternetService
                            0
      OnlineSecurity
```

OnlineBackup 0 DeviceProtection 0 TechSupport 0 ${\tt StreamingTV}$ 0 StreamingMovies 0 0 Contract PaperlessBilling 0 PaymentMethod 0 MonthlyCharges 0 TotalCharges 11 Churn 0 dtype: int64

[11]: df[np.isnan(df['TotalCharges'])]

[11]:		gender	SeniorCitize	en I	Partner	Der	oende	nts	ten	ure Pho	neService	\
	488	Female		0	Yes	•		Yes		0	No	
	753	Male		0	No			Yes		0	Yes	
	936	Female		0	Yes			Yes		0	Yes	
	1082	Male		0	Yes			Yes		0	Yes	
	1340	Female		0	Yes			Yes		0	No	
	3331	Male		0	Yes			Yes		0	Yes	
	3826	Male		0	Yes			Yes		0	Yes	
	4380	Female		0	Yes			Yes		0	Yes	
	5218	Male		0	Yes			Yes		0	Yes	
	6670	Female		0	Yes			Yes		0	Yes	
	6754	Male		0	No			Yes		0	Yes	
			ipleLines Int	eri				Onl	ine	Securit	•	
	488	No phon	e service		Ι	SL				Ye	_	
	753		No		_	No	No	inter	net	servic		
	936		No 		Ι	SL				Ye	_	
	1082		Yes		_	No	No	inter	rnet	servic		
	1340	No phon	e service		Γ	SL			_	Ye	_	
	3331		No			No				servic		
	3826		Yes			No				servic		
	4380		No			No				servic		
	5218		No		г	No	NO	inter	net	servic		
	6670 6754		Yes)SL)SL				N	-	
	0/54		Yes		L	ъъ				Ye	5	
			OnlineBackup		Device	Pro	tect	ion		Te	chSupport	\
	488		No					Yes			Yes	
	753	No inte	rnet service	No	o intern	net	serv	rice	No	interne	t service	
	936		Yes					Yes			No	
	1082	No inte	rnet service	No	o intern	net	serv	rice	No	interne	t service	
	1340		Yes					Yes			Yes	

```
3826 No internet service
                                  No internet service
                                                        No internet service
      4380
           No internet service
                                  No internet service
                                                        No internet service
      5218
            No internet service
                                  No internet service
                                                        No internet service
      6670
                             Yes
                                                   Yes
                                                                         Yes
      6754
                             Yes
                                                    No
                                                                         Yes
                    StreamingTV
                                      StreamingMovies
                                                        Contract PaperlessBilling
      488
                             Yes
                                                        Two year
                                                                               Yes
                                                    No
      753
            No internet service
                                  No internet service
                                                        Two year
                                                                                No
      936
                             Yes
                                                   Yes
                                                        Two year
                                                                                No
      1082
           No internet service
                                  No internet service
                                                        Two year
                                                                                No
      1340
                             Yes
                                                        Two year
                                                                                No
      3331
           No internet service
                                  No internet service
                                                        Two year
                                                                                No
      3826
           No internet service
                                  No internet service
                                                        Two year
                                                                                No
      4380 No internet service
                                  No internet service
                                                        Two year
                                                                                No
      5218
           No internet service
                                  No internet service
                                                        One year
                                                                               Yes
      6670
                             Yes
                                                    No
                                                        Two year
                                                                                No
      6754
                              No
                                                    No
                                                        Two year
                                                                               Yes
                         PaymentMethod
                                        MonthlyCharges
                                                         TotalCharges Churn
      488
            Bank transfer (automatic)
                                                  52.55
                                                                  NaN
                                                                          No
      753
                          Mailed check
                                                  20.25
                                                                  NaN
                                                                          No
      936
                          Mailed check
                                                  80.85
                                                                  NaN
                                                                          No
      1082
                          Mailed check
                                                  25.75
                                                                  NaN
                                                                          No
      1340
              Credit card (automatic)
                                                  56.05
                                                                  NaN
                                                                          No
                          Mailed check
      3331
                                                  19.85
                                                                  NaN
                                                                          No
      3826
                          Mailed check
                                                  25.35
                                                                  NaN
                                                                          No
      4380
                          Mailed check
                                                  20.00
                                                                  NaN
                                                                          No
      5218
                                                  19.70
                          Mailed check
                                                                  NaN
                                                                          No
      6670
                          Mailed check
                                                  73.35
                                                                  NaN
                                                                          No
      6754
            Bank transfer (automatic)
                                                  61.90
                                                                  NaN
                                                                          No
[12]: df[df['tenure'] == 0].index
[12]: Int64Index([488, 753, 936, 1082, 1340, 3331, 3826, 4380, 5218, 6670, 6754],
      dtype='int64')
[13]: df.drop(labels=df[df['tenure'] == 0].index, axis=0, inplace=True)
      df[df['tenure'] == 0].index
[13]: Int64Index([], dtype='int64')
[14]: df.fillna(df["TotalCharges"].mean())
[14]:
            gender
                    SeniorCitizen Partner Dependents tenure PhoneService
      0
            Female
                                       Yes
                                                    No
                                                             1
                                                                          No
```

No internet service No internet service

3331

No internet service

1	Male	0	No	No	34	Yes		
2	Male	0	No	No	2	Yes		
3	Male	0	No	No	45	No		
4	Female	0	No	No	2	Yes		
	•••		***	•••	•••			
7038	Male	0	Yes	Yes	24	Yes		
7039	Female	0	Yes	Yes	72	Yes		
7040	Female	0	Yes	Yes	11	No		
7041	Male	1	Yes	No	4	Yes		
7042	Male	0	No	No	66	Yes		
	MultipleLin	nes Inter	netService	OnlineSecu	rity Onl:	ineBackup \		
0	No phone servi	ce	DSL		No	Yes		
1		No	DSL		Yes	No		
2		No	DSL		Yes	Yes		
3	No phone servi	ce	DSL		Yes	No		
4		No F	iber optic		No	No		
•••	•••		•••	•••	•••			
7038	Y	es.	DSL		Yes	No		
7039			'iber optic		No	Yes		
7040	No phone servi		DSL		Yes	No		
7041	Y		'iber optic		No	No		
7042		No F	'iber optic		Yes	No		
	D	Т1. О						
	DeviceProtection			_	reamingMo		Contract \	
0	N	lo	No	No	eamingMo	No Month-t	o-month	
0 1	N Y∈	lo es	No No	No No	reamingMor	No Month-t	o-month ne year	
0 1 2	N Ye N	lo es lo	No No No	No No No	reamingMo	No Month-t No O No Month-t	o-month ne year o-month	
0 1 2 3	N Y∈ N Y∈	lo es lo es	No No No Yes	No No No No	reamingMo	No Month-t No 0 No Month-t No 0	o-month ne year o-month ne year	
0 1 2	N Y∈ N Y∈	lo es lo es	No No No Yes No	No No No		No Month-t No 0 No Month-t No 0 No Month-t	o-month ne year o-month	
0 1 2 3 4 	N Y∈ N Y∈ 	lo es lo es lo 	No No No Yes No	No No No No	reamingMo	No Month-t No 0 No Month-t No 0 No Month-t	o-month ine year o-month ine year o-month	
0 1 2 3 4 7038	N Y∈ N Y∈ N 	Jo es Jo es Jo 	No No No Yes No Yes	No No No No No		No Month-t No 0 No Month-t No 0 No Month-t Yes 0	o-month one year o-month ne year o-month	
0 1 2 3 4 7038 7039	M Ye M Ye Ye	Jo es Jo es Jo 	No No No Yes No Yes	No No No No Yes		No Month-t No 0 No Month-t No 0 No Month-t Yes 0	o-month ne year o-month ne year o-month ne year ne year	
0 1 2 3 4 7038 7039 7040	N Y∈ N Y∈ N Y∈ Y∈	Jo es Jo es	No No No Yes No Yes No	No No No No Yes Yes		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t	o-month ne year o-month ne year o-month ne year ne year ne year	
0 1 2 3 4 7038 7039 7040 7041	N Y∈ N Y∈ N Y∈ N	10 es 10 es 10 es es	No No No Yes No Yes No No No	No No No No Yes Yes		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 No Month-t No Month-t	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7039 7040	N Y∈ N Y∈ N Y∈ Y∈	10 es 10 es 10 es es	No No No Yes No Yes No	No No No No Yes Yes		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 No Month-t No Month-t	o-month ne year o-month ne year o-month ne year ne year ne year	
0 1 2 3 4 7038 7039 7040 7041 7042	\(\) \(\)	Jo es Jo es Jo Jo es Jo	No No Yes No Yes No No No No Yes	No No No No Yes Yes No No Yes		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7039 7040 7041 7042	M Ye N Ye N Ye Ye Ye PaperlessBillin	Jo es Jo es Jo es Jo es	No No No Yes No Yes No No No Yes	No No No No No Yes Yes No No Yes		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7039 7040 7041 7042	PaperlessBillin	Jo es Jo es Jo	No No No Yes No Wo No No Yes Payr	No No No No Yes Yes No No Yes entMethod onic check		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7040 7041 7042	PaperlessBillin	Jo es Jo es Jo es Jo es Jo es Jo es	No No No Yes No No No No Yes Payr Electro	No No No No Yes Yes No No Yes entMethod onic check iled check		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7040 7041 7042	PaperlessBillin	Jo es Jo es Jo es Jo es Jo es Jo es	No No No Yes No No No No Yes Payr Electro Mai	No No No No Yes Yes No No Yes entMethod onic check iled check iled check		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95 53.85	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7039 7041 7042 0 1 2 3	PaperlessBillir Ye N Ye Ye N Ye N Ye N Ye N Ye N Ye	Jo es	No No Yes No Wo Yes No No No Yes Payr Electro Mad Mad transfer (a	No No No No Yes Yes No No Yes entMethod onic check iled check iled check automatic)		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95 53.85 42.30	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7040 7041 7042	PaperlessBillin	Jo es	No No Yes No Wo Yes No No No Yes Payr Electro Mad Mad transfer (a	No No No No Yes Yes No No Yes entMethod onic check iled check iled check		No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95 53.85	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7040 7041 7042 0 1 2 3 4	PaperlessBillir Ye N Ye Ye N Ye N Ye N Ye N Ye N Ye	Jo es Jo es Jo es Jo es Jo es Bank es	No No No Yes No No No No Yes Payr Electro Mai transfer (a	No No No No Yes Yes No No Yes entMethod onic check iled check iled check automatic)	 Monthly	No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95 53.85 42.30 70.70	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7040 7041 7042 0 1 2 3 4 7038	PaperlessBillir Ye N Ye Ye Ye N Ye	Jo es Jo es Jo es Jo es Jo es Bank es	No No No Yes No Wo No No No Yes Payr Electro Mai transfer (a Electro Mai	No No No No No Yes Yes No No Yes mentMethod onic check iled check iled check automatic) onic check iiiid check iiiid check	 Monthly	No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95 53.85 42.30 70.70 84.80	o-month ne year o-month ne year o-month ne year ne year o-month o-month	
0 1 2 3 4 7038 7040 7041 7042 0 1 2 3 4 	PaperlessBillin Ye N Ye Ye Ye Ye N	Jo es	No No No Yes No Wo Yes No No No Yes Payr Electro Mai transfer (a Electro Mai dit card (a	No No No No No Yes Yes No No Yes mentMethod onic check iled check iled check automatic) onic check iiiid check iiiid check	 Monthly	No Month-t No 0 No Month-t No 0 No Month-t Yes 0 Yes 0 No Month-t No Month-t Yes T Charges \ 29.85 56.95 53.85 42.30 70.70	o-month ne year o-month ne year o-month ne year ne year o-month o-month	

```
7041
                                                                    74.40
                        Yes
                                            Mailed check
      7042
                        Yes Bank transfer (automatic)
                                                                   105.65
            TotalCharges Churn
      0
                   29.85
      1
                 1889.50
                             No
      2
                  108.15
                            Yes
      3
                             No
                 1840.75
      4
                  151.65
                            Yes
                   ...
      7038
                 1990.50
                             No
      7039
                 7362.90
                             No
      7040
                  346.45
                             No
      7041
                  306.60
                            Yes
      7042
                 6844.50
                             No
      [7032 rows x 20 columns]
[15]: df.isnull().sum()
[15]: gender
                           0
      SeniorCitizen
                           0
      Partner
                           0
                           0
      Dependents
                           0
      tenure
                           0
      PhoneService
      MultipleLines
                           0
      InternetService
                           0
      OnlineSecurity
      OnlineBackup
                           0
      DeviceProtection
                           0
                           0
      TechSupport
      StreamingTV
                           0
      StreamingMovies
                           0
      Contract
                           0
      PaperlessBilling
      PaymentMethod
                           0
      MonthlyCharges
                           0
      TotalCharges
                           0
                           0
      Churn
      dtype: int64
[16]: df["SeniorCitizen"] = df["SeniorCitizen"].map({0: "No", 1: "Yes"})
      df.head()
[16]:
         gender SeniorCitizen Partner Dependents tenure PhoneService \
      0 Female
                            No
                                   Yes
                                                No
                                                         1
                                                                      No
```

```
1
           Male
                            No
                                     No
                                                No
                                                         34
                                                                      Yes
      2
           Male
                                                          2
                                                                      Yes
                            No
                                     No
                                                 No
           Male
      3
                            No
                                     No
                                                 No
                                                         45
                                                                       No
        Female
                                                          2
                            No
                                     No
                                                 No
                                                                      Yes
            MultipleLines InternetService OnlineSecurity OnlineBackup \
         No phone service
                                        DSL
                                                         Nο
      0
      1
                                        DSL
                                                        Yes
                                                                       No
                        No
                                        DSL
                                                        Yes
                                                                      Yes
      2
                        No
      3
        No phone service
                                        DSL
                                                        Yes
                                                                       No
      4
                                Fiber optic
                                                         No
                                                                       No
                        No
        DeviceProtection TechSupport StreamingTV StreamingMovies
                                                                            Contract \
      0
                       No
                                    No
                                                No
                                                                      Month-to-month
                      Yes
                                    No
                                                No
      1
                                                                  No
                                                                            One year
      2
                                    No
                       No
                                                No
                                                                  No
                                                                      Month-to-month
      3
                      Yes
                                   Yes
                                                No
                                                                  No
                                                                            One year
      4
                       No
                                    No
                                                No
                                                                      Month-to-month
        PaperlessBilling
                                        PaymentMethod
                                                        MonthlyCharges
                                                                         TotalCharges
      0
                      Yes
                                     Electronic check
                                                                  29.85
                                                                                 29.85
                                         Mailed check
                                                                  56.95
      1
                       Nο
                                                                              1889.50
      2
                      Yes
                                         Mailed check
                                                                  53.85
                                                                                108.15
                       No Bank transfer (automatic)
      3
                                                                  42.30
                                                                              1840.75
      4
                      Yes
                                     Electronic check
                                                                  70.70
                                                                                151.65
        Churn
      0
           No
           No
      1
      2
          Yes
      3
           No
      4
          Yes
[17]: df["InternetService"].describe(include=['object', 'bool'])
[17]: count
                        7032
      unique
                           3
      top
                 Fiber optic
                        3096
      freq
      Name: InternetService, dtype: object
[18]: numerical_cols = ['tenure', 'MonthlyCharges', 'TotalCharges']
      df[numerical_cols].describe()
「18]:
                   tenure
                           MonthlyCharges
                                            TotalCharges
      count
             7032.000000
                              7032.000000
                                             7032.000000
               32.421786
                                 64.798208
                                             2283.300441
      mean
```

std	24.545260	30.085974	2266.771362
min	1.000000	18.250000	18.800000
25%	9.000000	35.587500	401.450000
50%	29.000000	70.350000	1397.475000
75%	55.000000	89.862500	3794.737500
max	72 000000	118 750000	8684 800000