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Section: A2

Course No: EEE 4416

Exercises

Exercise-1:

```
Yu=input('Enter number of test cases: ');
for ii=1:Yu
    a=input('1st integer:')
    b=input('2nd integer:')
    Output=amicable_pair(a,b)
end
```

```
a = 220
b = 374
Output =
'False'
a = 2620
b = 2924
Output =
'True'
a = 66928
b = 66992
Output =
'True'
```

Exercise-2:

```
pu=input('Enter number of test cases: ');
for ii=1:pu
    A1=input('Enter an integer: ')
    OuT=goldbach_marginal(A1)
end
```

```
A1 = 5
OuT =
"Numbers below 5 don’t satisfy the conjecture."
A1 = 15
OuT = 3×3
     2     2    11
     3     5     7
     5     5     5
A1 = 18
OuT = 2×3
     2     3    13
     2     5    11
A1 = 7
OuT = 1×3
```

```
     2     2     3
A1 = 19
OuT = 3×3
     3     3    13
     3     5    11
     5     7     7
```

Exercise-3:

```
uu=input('Enter number of test cases: ');
for ii=1:uu
    A1=input('1st integer: ')
    B1=input('2nd integer: ')
    C1=input('Enter string or space: ','s')
    if C1==' '
        OuT=lunar_add(A1,B1)
    else
        OuT=lunar_add(A1,B1,C1)
    end
end
```

```
A1 = 5
B1 = 9
C1 =

  0×0 empty char array
OuT = 9
A1 = 482
B1 = 24314
C1 =

  0×0 empty char array
OuT = 24484
A1 = 482
B1 = 24314
C1 =
'Multiplication'
OuT = 2443442
A1 = 169
B1 = 248
C1 =
'Multiplication'
OuT = 12468
A1 = 169
B1 = 248
C1 =
'Addition'
OuT = 269
```

Exercise-4:

```
Departments = ["CSE"; "EEE";"ME"; "CIVIL"; "CE"; "Architecture"; "Management"];
BUET = [120; 180; 150; 195; 40; 100; 50];
RUET = [120; 120; 80; 80; NaN; 50; 50];
KUET = [100; 150; 150; 150; 30; 80; NaN];
CUET = [80; 80; 80; 80; 80; 80; 80];
```

```
IUT = [40; 80; 55; 45; NaN; NaN; 30];
University_BD = table(Departments, BUET, RUET, KUET, CUET, IUT);
disp(University_BD)
```

```
    Departments       BUET    RUET    KUET    CUET    IUT
    _____________     ____    ____    ____    ____    ___

    "CSE"             120     120     100      80      40
    "EEE"             180     120     150      80      80
    "ME"              150      80     150      80      55
    "CIVIL"           195      80     150      80      45
    "CE"               40     NaN      30      80     NaN
    "Architecture"    100      50      80      80     NaN
    "Management"       50      50     NaN      80      30
```

```
total_CUET = sum(University_BD.CUET, 'omitnan');
STUDEN_IN_CUET=total_CUET
```

```
STUDEN_IN_CUET = 560
```

```
University_BD.DU = [100; 110; 90; 95; 50; 70; 40]
```

University_BD = 7×7 table

	Departments	BUET	RUET	KUET	CUET	IUT	DU
1	"CSE"	120	120	100	80	40	100
2	"EEE"	180	120	150	80	80	110
3	"ME"	150	80	150	80	55	90
4	"CIVIL"	195	80	150	80	45	95
5	"CE"	40	NaN	30	80	NaN	50
6	"Architecture"	100	50	80	80	NaN	70
7	"Management"	50	50	NaN	80	30	40

```
University_BD(strcmp(University_BD.Departments, 'Management'), :) = []
```

University_BD = 6×7 table

	Departments	BUET	RUET	KUET	CUET	IUT	DU
1	"CSE"	120	120	100	80	40	100
2	"EEE"	180	120	150	80	80	110
3	"ME"	150	80	150	80	55	90
4	"CIVIL"	195	80	150	80	45	95
5	"CE"	40	NaN	30	80	NaN	50
6	"Architecture"	100	50	80	80	NaN	70

```
University_BD.CUET = []
```

University_BD = 6×6 table

	Departments	BUET	RUET	KUET	IUT	DU
1	"CSE"	120	120	100	40	100

	Departments	BUET	RUET	KUET	IUT	DU
2	"EEE"	180	120	150	80	110
3	"ME"	150	80	150	55	90
4	"CIVIL"	195	80	150	45	95
5	"CE"	40	NaN	30	NaN	50
6	"Architecture"	100	50	80	NaN	70

```
University_BD.Properties.VariableNames{'KUET'} = 'MIST'
```

University_BD = 6×6 table

	Departments	BUET	RUET	MIST	IUT	DU
1	"CSE"	120	120	100	40	100
2	"EEE"	180	120	150	80	110
3	"ME"	150	80	150	55	90
4	"CIVIL"	195	80	150	45	95
5	"CE"	40	NaN	30	NaN	50
6	"Architecture"	100	50	80	NaN	70

```
University_BD.Departments = categorical(University_BD.Departments)
```

University_BD = 6×6 table

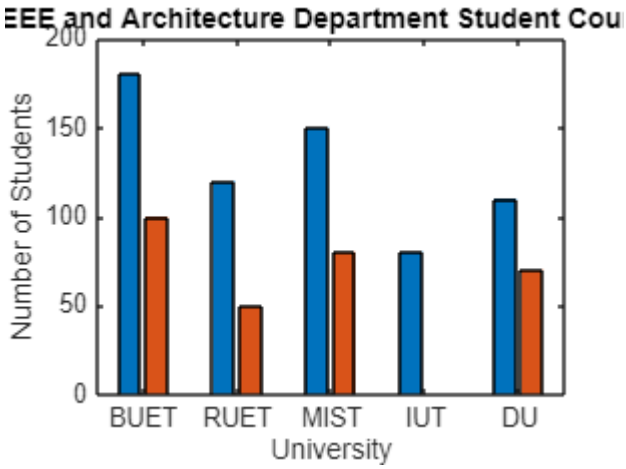
	Departments	BUET	RUET	MIST	IUT	DU
1	CSE	120	120	100	40	100
2	EEE	180	120	150	80	110
3	ME	150	80	150	55	90
4	CIVIL	195	80	150	45	95
5	CE	40	NaN	30	NaN	50
6	Architecture	100	50	80	NaN	70

```
summary(University_BD)
```

```
Variables:

    Departments: 6×1 categorical

        Values:

            Architecture       1
            CE                 1
            CIVIL              1
            CSE                1
            EEE                1
            ME                 1

    BUET: 6×1 double
```

```
    Values:

        Min          40
        Median      135
        Max         195

RUET: 6×1 double

    Values:

        Min             50
        Median          80
        Max             120
        NumMissing      1

MIST: 6×1 double

    Values:

        Min          30
        Median      125
        Max         150

IUT: 6×1 double

    Values:

        Min              40
        Median           50
        Max              80
        NumMissing       2

DU: 6×1 double

    Values:

        Min           50
        Median      92.5
        Max          110
```

```
rows_to_plot = ismember(cellstr(University_BD.Departments), {'EEE',
'Architecture'});
plotData = University_BD(rows_to_plot, :);
universities = University_BD.Properties.VariableNames(2:end);
studentCounts = plotData{:, 2:end};
figure;
bar(studentCounts')
title('EEE and Architecture Department Student Counts')
xlabel('University')
ylabel('Number of Students')
xticklabels(universities)
```



Exercise-5:

```
cities = readtable('worldcities.csv');
% I:
uniqueCountries=unique(cities.country);
numberOfUnique=length(uniqueCountries)
```

```
numberOfUnique = 223
```

```
if length(cities.country)>length(uniqueCountries)
    'Yes, file has duplicate countries'
end
```

```
ans =
'Yes, file has duplicate countries'
```

```
% II:
sum(cities.population>1e7)
```

```
ans = 39
```

```
% III:
cities(cities.population>5e6,:)
```

ans = 146×11 table

...

	city	city_ascii	lat	lng	country	iso2	iso3
1	'Tokyo'	'Tokyo'	35.6897	139.6922	'Japan'	'JP'	'JPN'
2	'Jakarta'	'Jakarta'	-6.2146	106.8451	'Indonesia'	'ID'	'IDN'
3	'Delhi'	'Delhi'	28.6600	77.2300	'India'	'IN'	'IND'
4	'Mumbai'	'Mumbai'	18.9667	72.8333	'India'	'IN'	'IND'
5	'Manila'	'Manila'	14.5958	120.9772	'Philippines'	'PH'	'PHL'
6	'Shanghai'	'Shanghai'	31.1667	121.4667	'China'	'CN'	'CHN'
7	'São Paulo'	'Sao Paulo'	-23.5504	-46.6339	'Brazil'	'BR'	'BRA'

	city	city_ascii	lat	lng	country	iso2	iso3
8	'Seoul'	'Seoul'	37.5833	127	'Korea, South'	'KR'	'KOR'
9	'Mexico City'	'Mexico City'	19.4333	-99.1333	'Mexico'	'MX'	'MEX'
10	'Guangzhou'	'Guangzhou'	23.1288	113.2590	'China'	'CN'	'CHN'
11	'Beijing'	'Beijing'	39.9050	116.3914	'China'	'CN'	'CHN'
12	'Cairo'	'Cairo'	30.0561	31.2394	'Egypt'	'EG'	'EGY'
13	'New York'	'New York'	40.6943	-73.9249	'United States'	'US'	'USA'
14	'Kolkāta'	'Kolkata'	22.5411	88.3378	'India'	'IN'	'IND'

⋮

```
% IV:
primary=cities(strcmp(cities.capital,'primary'),:)
```

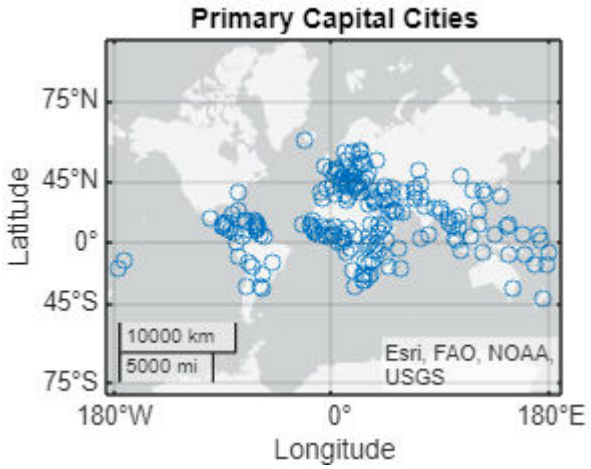
```
primary = 208×11 table
```

...

	city	city_ascii	lat	lng	country	iso2	iso3
1	'Tokyo'	'Tokyo'	35.6897	139.6922	'Japan'	'JP'	'JPN'
2	'Jakarta'	'Jakarta'	-6.2146	106.8451	'Indonesia'	'ID'	'IDN'
3	'Manila'	'Manila'	14.5958	120.9772	'Philippines'	'PH'	'PHL'
4	'Seoul'	'Seoul'	37.5833	127	'Korea, South'	'KR'	'KOR'
5	'Mexico City'	'Mexico City'	19.4333	-99.1333	'Mexico'	'MX'	'MEX'
6	'Beijing'	'Beijing'	39.9050	116.3914	'China'	'CN'	'CHN'
7	'Cairo'	'Cairo'	30.0561	31.2394	'Egypt'	'EG'	'EGY'
8	'Moscow'	'Moscow'	55.7558	37.6178	'Russia'	'RU'	'RUS'
9	'Bangkok'	'Bangkok'	13.7500	100.5167	'Thailand'	'TH'	'THA'
10	'Buenos Aires'	'Buenos Aires'	-34.5997	-58.3819	'Argentina'	'AR'	'ARG'
11	'Dhaka'	'Dhaka'	23.7161	90.3961	'Bangladesh'	'BD'	'BGD'
12	'Tehran'	'Tehran'	35.7000	51.4167	'Iran'	'IR'	'IRN'
13	'Kinshasa'	'Kinshasa'	-4.3317	15.3139	'Congo (Kinshasa)'	'CD'	'COD'
14	'Paris'	'Paris'	48.8566	2.3522	'France'	'FR'	'FRA'

⋮

```
% V:
figure;
geoscatter(primary.lat,primary.lng);
title('Primary Capital Cities');
```




```
% VI:
BD_US=cities(strcmp(cities.country,'Bangladesh')|strcmp(cities.country,'United States'),:)
```

BD_US = 7786×11 table

...

	city	city_ascii	lat	lng	country	iso2	iso3
1	'New York'	'New York'	40.6943	-73.9249	'United States'	'US'	'USA'
2	'Dhaka'	'Dhaka'	23.7161	90.3961	'Bangladesh'	'BD'	'BGD'
3	'Los Angeles'	'Los Angeles'	34.1139	-118.4068	'United States'	'US'	'USA'
4	'Chicago'	'Chicago'	41.8373	-87.6862	'United States'	'US'	'USA'
5	'Miami'	'Miami'	25.7839	-80.2102	'United States'	'US'	'USA'
6	'Dallas'	'Dallas'	32.7936	-96.7662	'United States'	'US'	'USA'
7	'Philadelphia'	'Philadelphia'	40.0077	-75.1339	'United States'	'US'	'USA'
8	'Houston'	'Houston'	29.7863	-95.3889	'United States'	'US'	'USA'
9	'Atlanta'	'Atlanta'	33.7627	-84.4224	'United States'	'US'	'USA'
10	'Washington'	'Washington'	38.9047	-77.0163	'United States'	'US'	'USA'
11	'Boston'	'Boston'	42.3188	-71.0846	'United States'	'US'	'USA'
12	'Phoenix'	'Phoenix'	33.5722	-112.0891	'United States'	'US'	'USA'
13	'Seattle'	'Seattle'	47.6211	-122.3244	'United States'	'US'	'USA'
14	'San Francisco'	'San Francisco'	37.7562	-122.4430	'United States'	'US'	'USA'

⋮

```
% VII:
rawNames = BD_US.country;
uniqNames = matlab.lang.makeUniqueStrings(rawNames);
T = BD_US(:, {'city','population'});
T.Properties.RowNames = uniqNames
```

T = 7786×2 table

	city	population
1 United States	'New York'	18713220
2 Bangladesh	'Dhaka'	15443000
3 United States_1	'Los Angeles'	12750807
4 United States_2	'Chicago'	8604203
5 United States_3	'Miami'	6445545
6 United States_4	'Dallas'	5743938
7 United States_5	'Philadelphia'	5649300
8 United States_6	'Houston'	5464251
9 United States_7	'Atlanta'	5449398
10 United States_8	'Washington'	5379184
11 United States_9	'Boston'	4688346
12 United States_10	'Phoenix'	4219697
13 United States_11	'Seattle'	3789215
14 United States_12	'San Francisco'	3592294

⋮

Exercise-6:

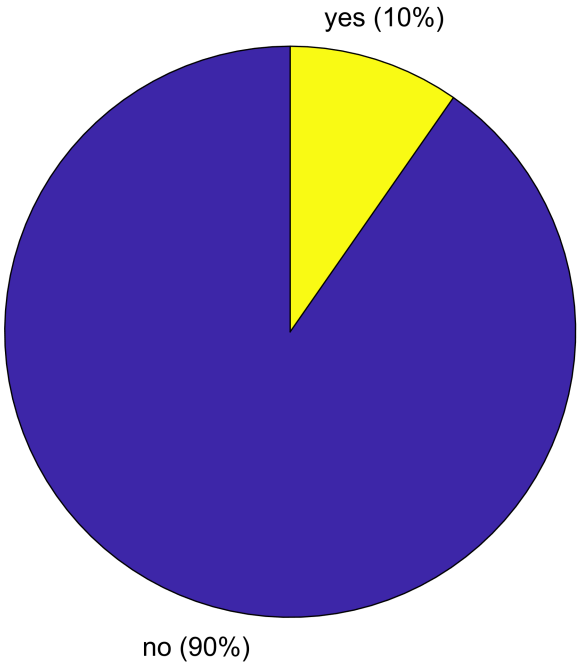
```
ML = readtable('BigML_Dataset.csv');
```

```
Warning: Column headers from the file were modified to make them valid MATLAB identifiers before creating
variable names for the table. The original column headers are saved in the VariableDescriptions property.
Set 'VariableNamingRule' to 'preserve' to use the original column headers as table variable names.
```

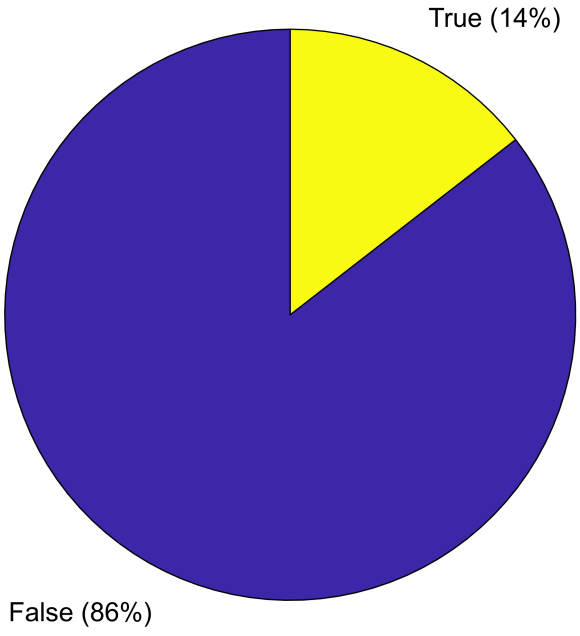
```
% i:
sum(ismissing(ML),'all')
```

```
ans = 0
```

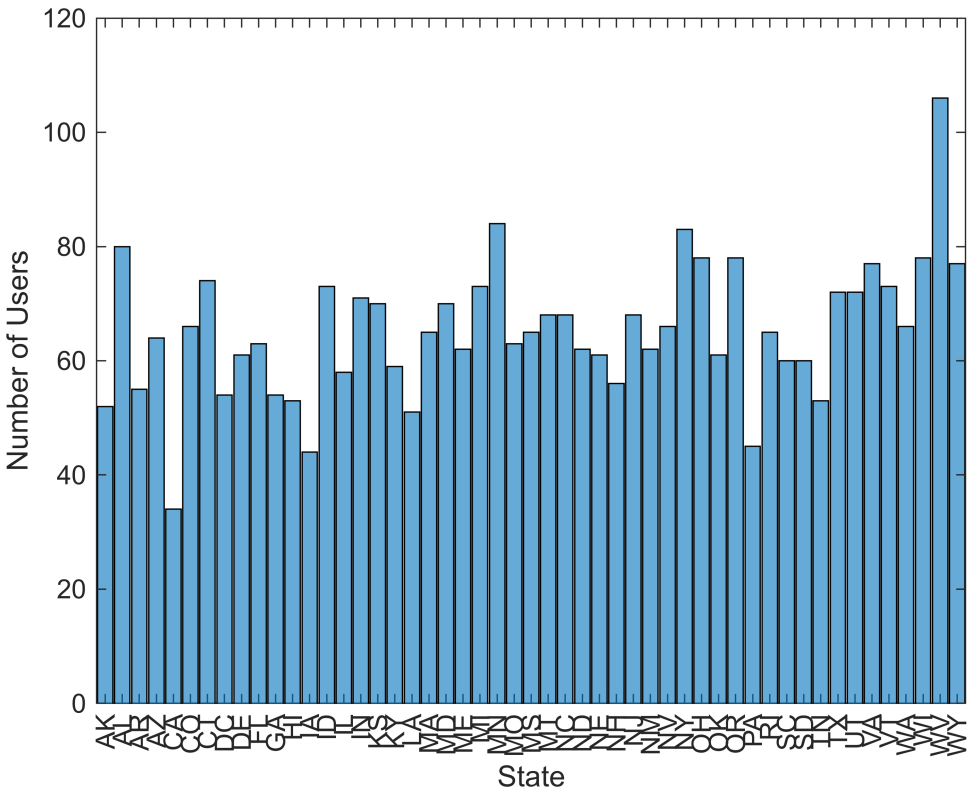
```
% ii:
pie(categorical(ML.internationalPlan))
```




```
pie(categorical(ML.churn))
```



```
% iii:
histogram(categorical(ML.state));
xlabel('State');
ylabel('Number of Users');
```




```
% iv:
a=char(join(string(ML.state)));
b=string(unique(ML.state));
c=regexp(a,b);
[~,d]=max(cellfun(@length,c));
ML.state{d}
```

```
ans =
'WY'
```

```
% v:
a=char(join(string(ML.state)));
b=ML.state(strcmp(ML.churn,'True'));
c=regexp(a,b);
[~,d]=max(cellfun(@length,c));
ML.state{d}
```

```
ans =
'NC'
```

```
% vi:
sum(ML.customerServiceCalls>1)
```

```
ans = 1455
```

```
% vii:
ML.totalCharge=ML.totalDayCharge+ML.totalNightCharge+ML.totalEveCharge+ML.totalIntlCharge
```

```
ML = 3333×22 table
```

...

	state	accountLength	areaCode	phoneNumber	internationalPlan
1	'KS'	128	415	'382-4657'	'no'
2	'OH'	107	415	'371-7191'	'no'
3	'NJ'	137	415	'358-1921'	'no'
4	'OH'	84	408	'375-9999'	'yes'
5	'OK'	75	415	'330-6626'	'yes'
6	'AL'	118	510	'391-8027'	'yes'
7	'MA'	121	510	'355-9993'	'no'
8	'MO'	147	415	'329-9001'	'yes'
9	'LA'	117	408	'335-4719'	'no'
10	'WV'	141	415	'330-8173'	'yes'
11	'IN'	65	415	'329-6603'	'no'
12	'RI'	74	415	'344-9403'	'no'
13	'IA'	168	408	'363-1107'	'no'
14	'MT'	95	510	'394-8006'	'no'
15	'IA'	62	415	'366-9238'	'no'
16	'NY'	161	415	'351-7269'	'no'
17	'ID'	85	408	'350-8884'	'no'
18	'VT'	93	510	'386-2923'	'no'
19	'VA'	76	510	'356-2992'	'no'
20	'TX'	73	415	'373-2782'	'no'
21	'FL'	147	415	'396-5800'	'no'
22	'CO'	77	408	'393-7984'	'no'
23	'AZ'	130	415	'358-1958'	'no'
24	'SC'	111	415	'350-2565'	'no'
25	'VA'	132	510	'343-4696'	'no'
26	'NE'	174	415	'331-3698'	'no'
27	'WY'	57	408	'357-3817'	'no'
28	'MT'	54	408	'418-6412'	'no'

	state	accountLength	areaCode	phoneNumber	internationalPlan
29	'MO'	20	415	'353-2630'	'no'
30	'HI'	49	510	'410-7789'	'no'
31	'IL'	142	415	'416-8428'	'no'
32	'NH'	75	510	'370-3359'	'no'
33	'LA'	172	408	'383-1121'	'no'
34	'AZ'	12	408	'360-1596'	'no'
35	'OK'	57	408	'395-2854'	'no'
36	'GA'	72	415	'362-1407'	'no'
37	'AK'	36	408	'341-9764'	'no'
38	'MA'	78	415	'353-3305'	'no'
39	'AK'	136	415	'402-1381'	'yes'
40	'NJ'	149	408	'332-9891'	'no'
41	'GA'	98	408	'372-9976'	'no'
42	'MD'	135	408	'383-6029'	'yes'
43	'AR'	34	510	'353-7289'	'no'
44	'ID'	160	415	'390-7274'	'no'
45	'WI'	64	510	'352-1237'	'no'
46	'OR'	59	408	'353-3061'	'no'
47	'MI'	65	415	'363-5450'	'no'
48	'DE'	142	408	'364-1995'	'no'
49	'ID'	119	415	'398-1294'	'no'
50	'WY'	97	415	'405-7146'	'no'
51	'IA'	52	408	'413-4957'	'no'
52	'IN'	60	408	'420-5645'	'no'
53	'VA'	10	408	'349-4396'	'no'
54	'UT'	96	415	'404-3211'	'no'
55	'WY'	87	415	'353-3759'	'no'
56	'IN'	81	408	'363-5947'	'no'
57	'CO'	141	415	'340-5121'	'no'
58	'CO'	121	408	'370-7574'	'no'
59	'WI'	68	415	'403-9733'	'no'
60	'OK'	125	408	'355-7251'	'no'
61	'ID'	174	408	'359-5893'	'no'

	state	accountLength	areaCode	phoneNumber	internationalPlan
62	'CA'	116	415	'405-3371'	'no'
63	'MN'	74	510	'344-5117'	'no'
64	'SD'	149	408	'332-8160'	'no'
65	'NC'	38	408	'359-4081'	'no'
66	'WA'	40	415	'352-8305'	'no'
67	'WY'	43	415	'329-9847'	'yes'
68	'MN'	113	408	'365-9011'	'yes'
69	'UT'	126	408	'338-9472'	'no'
70	'TX'	150	510	'374-8042'	'no'
71	'NJ'	138	408	'359-1231'	'no'
72	'MN'	162	510	'413-7170'	'no'
73	'NM'	147	510	'415-2935'	'no'
74	'NV'	90	415	'399-4246'	'no'
75	'HI'	85	415	'362-5889'	'no'
76	'MN'	50	415	'350-8921'	'no'
77	'DC'	82	415	'374-5353'	'no'
78	'NY'	144	408	'360-1171'	'no'
79	'MN'	46	415	'355-8887'	'no'
80	'MD'	70	408	'333-1967'	'no'
81	'WV'	144	415	'354-4577'	'no'
82	'OR'	116	415	'331-7425'	'yes'
83	'CO'	55	408	'419-2637'	'no'
84	'GA'	70	415	'411-1530'	'no'
85	'TX'	106	510	'395-3026'	'no'
86	'VT'	128	510	'388-6441'	'no'
87	'IN'	94	408	'402-1251'	'no'
88	'WV'	111	510	'412-9997'	'no'
89	'KY'	74	415	'346-7302'	'no'
90	'NJ'	128	415	'358-9095'	'no'
91	'DC'	82	510	'400-9770'	'no'
92	'LA'	155	415	'334-1275'	'no'
93	'AR'	80	415	'340-4953'	'no'
94	'ME'	78	415	'400-9510'	'no'

	state	accountLength	areaCode	phoneNumber	internationalPlan
95	'AZ'	90	415	'387-6103'	'no'
96	'AK'	104	408	'366-4467'	'no'
97	'MT'	73	415	'370-3450'	'no'
98	'AZ'	99	415	'327-3954'	'no'
99	'MS'	120	408	'355-6291'	'no'
100	'ID'	77	415	'362-9748'	'no'

⋮

```
% viii:
a=char(join(string(ML.state)));
b=string(unique(ML.state));
c=regexp(a,b);
c=cellfun(@(s) (s-1)/3+1,c,'UniformOutput',false);
d=cellfun(@(s) mean(ML.totalCharge(s)),c,'UniformOutput',false);
mean([d{:}])
```

```
ans = 59.4336
```

```
% ix:
BigMLDataset.phoneNumber
```

```
ans = 3333×1
   382
   371
   358
   375
   330
   391
   355
   329
   335
   330
     ⋮
```

```
ML.phoneNumber
```

```
ans = 3333×1 cell
'382-4657'
'371-7191'
'358-1921'
'375-9999'
'330-6626'
'391-8027'
'355-9993'
'329-9001'
'335-4719'
'330-8173'
     ⋮
```

```
% x:
```

```
regexprep(ML.phoneNumber,'-','')
```

```
ans = 3333×1 cell
'3824657'
'3717191'
'3581921'
'3759999'
'3306626'
'3918027'
'3559993'
'3299001'
'3354719'
'3308173'
     ⋮
```

Exercise-1 function:

```
function out=amicable_pair(a,b)
P=[];
Q=[];
for I=1:(a/2)
    if mod(a,I)==0
        P(end+1)=I;
    else
        continue;
    end
end
for I=1:(b/2)
    if mod(b,I)==0
        Q(end+1)=I;
    else
        continue;
    end
end
if a==sum(Q) && b==sum(P)
    out='True';
else
    out='False';
end
end
```

Exercise-2 function:

```
function result=goldbach_marginal(n)
    if n<6
        result="Numbers below 5 don’t satisfy the conjecture.";
        return
    end
    result=[];
    p=primes(n);
    for i=1:length(p)
```

```
        a=p(i);
        r=n-a;
        q=primes(r);
        for j=1:length(q)
            b=q(j);
            c=r-b;
            if isprime(c)
                triplet=sort([a, b, c]);
                result=[result; triplet];
                break;
            end
        end
    end
    if mod(n,3)==0 && isprime(n/3)
        result=[result;repmat(n/3,1,3)];
    end
    result=unique(sort(result,2),'rows');
end
```

Exercise-3 function:

```
function output=lunar_add(a,b,s)
    if nargin<3
        s='Addition';
    end
    c=num2str(a)-'0';
    d=num2str(b)-'0';
    len = max(length(c), length(d));
    c=[zeros(1,len-length(c)),c];
    d=[zeros(1,len-length(d)),d];

    switch s
        case 'Multiplication'
            M=zeros(len);
            for i=1:len
                for j=1:len
                    M(i,j+len-i)=min(c(j),d(len-i+1));
                end
            end
            output=max(M,[],1);
            output=str2num(char(output+'0'));
        otherwise
            output=max(c,d);
            output=str2num(char(output +'0'));
    end
end
```