import libraries

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

import dataset

In [2]:
```
dataset = pd.read_csv('bank.csv')
```

In [3]:
```
dataset.head()
```

Out[3]:

	age	job	marital	education	default	balance	housing	loan	contact	day	month	duratic
0	59	admin.	married	secondary	no	2343	yes	no	unknown	5	may	10
1	56	admin.	married	secondary	no	45	no	no	unknown	5	may	14
2	41	technician	married	secondary	no	1270	yes	no	unknown	5	may	13
3	55	services	married	secondary	no	2476	yes	no	unknown	5	may	5
4	54	admin.	married	tertiary	no	184	no	no	unknown	5	may	6

check the dataset structe

In [4]:
```
dataset.info
```

Out[4]:
```
<bound method DataFrame.info of        age          job  marital  education default  bal
ance housing loan  \
0       59       admin.  married  secondary      no     2343     yes   no
1       56       admin.  married  secondary      no       45      no   no
2       41   technician  married  secondary      no     1270     yes   no
3       55     services  married  secondary      no     2476     yes   no
4       54       admin.  married   tertiary      no      184      no   no
...    ...          ...      ...        ...     ...      ...     ...  ...
11157   33  blue-collar   single    primary      no        1     yes   no
11158   39     services  married  secondary      no      733      no   no
11159   32   technician   single  secondary      no       29      no   no
11160   43   technician  married  secondary      no        0      no  yes
11161   34   technician  married  secondary      no        0      no   no

        contact  day month  duration  campaign  pdays  previous poutcome  \
0       unknown    5   may      1042         1     -1         0  unknown
1       unknown    5   may      1467         1     -1         0  unknown
2       unknown    5   may      1389         1     -1         0  unknown
3       unknown    5   may       579         1     -1         0  unknown
```

```
4       unknown    5   may       673         2     -1         0  unknown
...         ...  ...   ...       ...       ...    ...       ...      ...
11157  cellular   20   apr       257         1     -1         0  unknown
11158   unknown   16   jun        83         4     -1         0  unknown
11159  cellular   19   aug       156         2     -1         0  unknown
11160  cellular    8   may         9         2    172         5  failure
11161  cellular    9   jul       628         1     -1         0  unknown

      deposit
0         yes
1         yes
2         yes
3         yes
4         yes
...       ...
11157      no
11158      no
11159      no
11160      no
11161      no

[11162 rows x 17 columns]>
```

find number of rows and column

In [5]:
```
dataset.shape
```

Out[5]:
```
(11162, 17)
```

describe dataset numerical columns

In [6]:
```
dataset.describe()
```

Out[6]:

	age	balance	day	duration	campaign	pdays	previou
count	11162.000000	11162.000000	11162.000000	11162.000000	11162.000000	11162.000000	11162.00000
mean	41.231948	1528.538524	15.658036	371.993818	2.508421	51.330407	0.83255
std	11.913369	3225.413326	8.420740	347.128386	2.722077	108.758282	2.29200
min	18.000000	-6847.000000	1.000000	2.000000	1.000000	-1.000000	0.00000
25%	32.000000	122.000000	8.000000	138.000000	1.000000	-1.000000	0.00000
50%	39.000000	550.000000	15.000000	255.000000	2.000000	-1.000000	0.00000
75%	49.000000	1708.000000	22.000000	496.000000	3.000000	20.750000	1.00000
max	95.000000	81204.000000	31.000000	3881.000000	63.000000	854.000000	58.00000

find the unique values from categorical

features

In [7]:
```
for col in dataset.select_dtypes(include='object').columns:
    print(col)
    print(dataset[col].unique())
```

```
job
['admin.' 'technician' 'services' 'management' 'retired' 'blue-collar'
 'unemployed' 'entrepreneur' 'housemaid' 'unknown' 'self-employed'
 'student']
marital
['married' 'single' 'divorced']
education
['secondary' 'tertiary' 'primary' 'unknown']
default
['no' 'yes']
housing
['yes' 'no']
loan
['no' 'yes']
contact
['unknown' 'cellular' 'telephone']
month
['may' 'jun' 'jul' 'aug' 'oct' 'nov' 'dec' 'jan' 'feb' 'mar' 'apr' 'sep']
poutcome
['unknown' 'other' 'failure' 'success']
deposit
['yes' 'no']
```

Find Missing Values

In [8]:
```
features_na = [features for features in dataset.columns if dataset[features].isnull().s
for feature in features_na:
    print(feature, np.round(dataset[feature].isnull().mean(), 4),  ' % missing values')
else:
    print("No missing value found")
```

```
No missing value found
```

Find Features with One Value

In [9]:
```
for column in dataset.columns:
    print(column,dataset[column].nunique())
```

```
age 76
job 12
marital 3
education 4
default 2
balance 3805
housing 2
loan 2
contact 3
day 31
```

```
month 12
duration 1428
campaign 36
pdays 472
previous 34
poutcome 4
deposit 2
```

Categorical Features

In [10]:
```
categorical_features=[feature for feature in dataset.columns if ((dataset[feature].dtyp
categorical_features
```

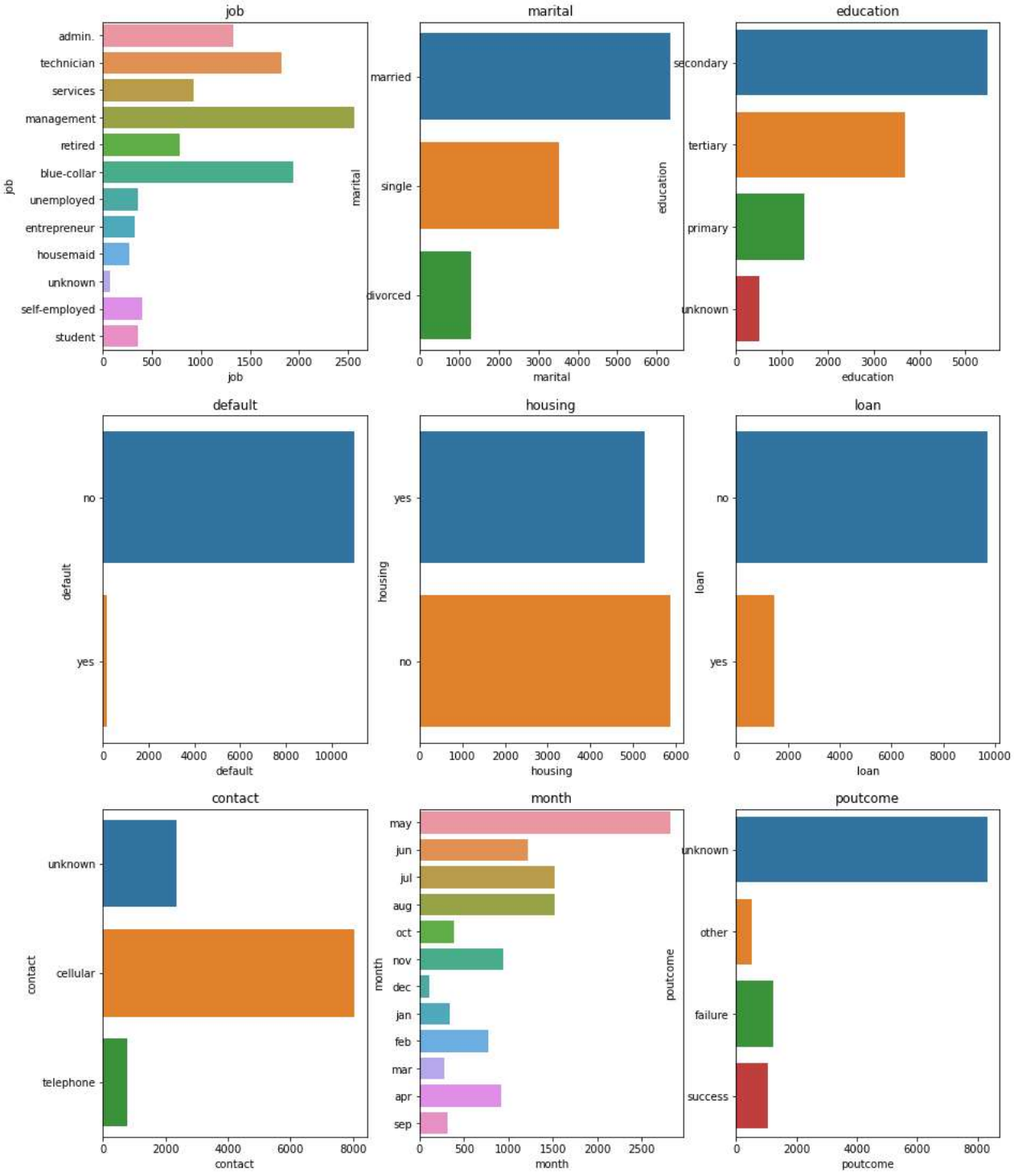
Out[10]:
```
['job',
 'marital',
 'education',
 'default',
 'housing',
 'loan',
 'contact',
 'month',
 'poutcome']
```

In [11]:
```
for feature in categorical_features:
    print('The feature is {} and number of categories are {}'.format(feature,len(datase
```

```
The feature is job and number of categories are 12
The feature is marital and number of categories are 3
The feature is education and number of categories are 4
The feature is default and number of categories are 2
The feature is housing and number of categories are 2
The feature is loan and number of categories are 2
The feature is contact and number of categories are 3
The feature is month and number of categories are 12
The feature is poutcome and number of categories are 4
```

check count based on categorical features

In [12]:
```
plt.figure(figsize=(15,80), facecolor='white')
plotnumber =1
for categorical_feature in categorical_features:
    ax = plt.subplot(12,3,plotnumber)
    sns.countplot(y=categorical_feature,data=dataset)
    plt.xlabel(categorical_feature)
    plt.title(categorical_feature)
    plotnumber+=1
plt.show()
```



Explore the Numerical Features

In [13]:
```
# list of numerical variables
numerical_features = [feature for feature in dataset.columns if ((dataset[feature].dtyp
print('Number of numerical variables: ', len(numerical_features))

# visualise the numerical variables
dataset[numerical_features].head()
```

```
Number of numerical variables:  7
```

Out[13]:

	age	balance	day	duration	campaign	pdays	previous

	age	balance	day	duration	campaign	pdays	previous
0	59	2343	5	1042	1	-1	0
1	56	45	5	1467	1	-1	0
2	41	1270	5	1389	1	-1	0
3	55	2476	5	579	1	-1	0
4	54	184	5	673	2	-1	0