Imports

In [ ]:
```
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt
import seaborn as sns
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.model_selection import train_test_split
from itertools import combinations
```

Reading data

In [ ]:
```
data_path = "../data/lab_5/admit.xlsx"
```

In [ ]:
```
df = pd.read_excel(data_path)
df
```

Out[ ]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65
...	...	...	...	...	...	...	...	...	...
395	396	324	110	3	3.5	3.5	9.04	1	0.82
396	397	325	107	3	3.0	3.5	9.11	1	0.84
397	398	330	116	4	5.0	4.5	9.45	1	0.91
398	399	312	103	3	3.5	4.0	8.78	0	0.67
399	400	333	117	4	5.0	4.0	9.66	1	0.95

400 rows × 9 columns

In [ ]:
```
df.columns
```

Out[ ]:
```
Index(['Serial No.', 'GRE Score', 'TOEFL Score', 'University Rating', 'SOP',
       'LOR ', 'CGPA', 'Research', 'Chance of Admit '],
      dtype='object')
```

Data types:

Nominal:

Serial No.

Binary:

Research

Ordinal:

University Rating

Discrete:

GRE Score, TOEFL Score, SOP, LOR

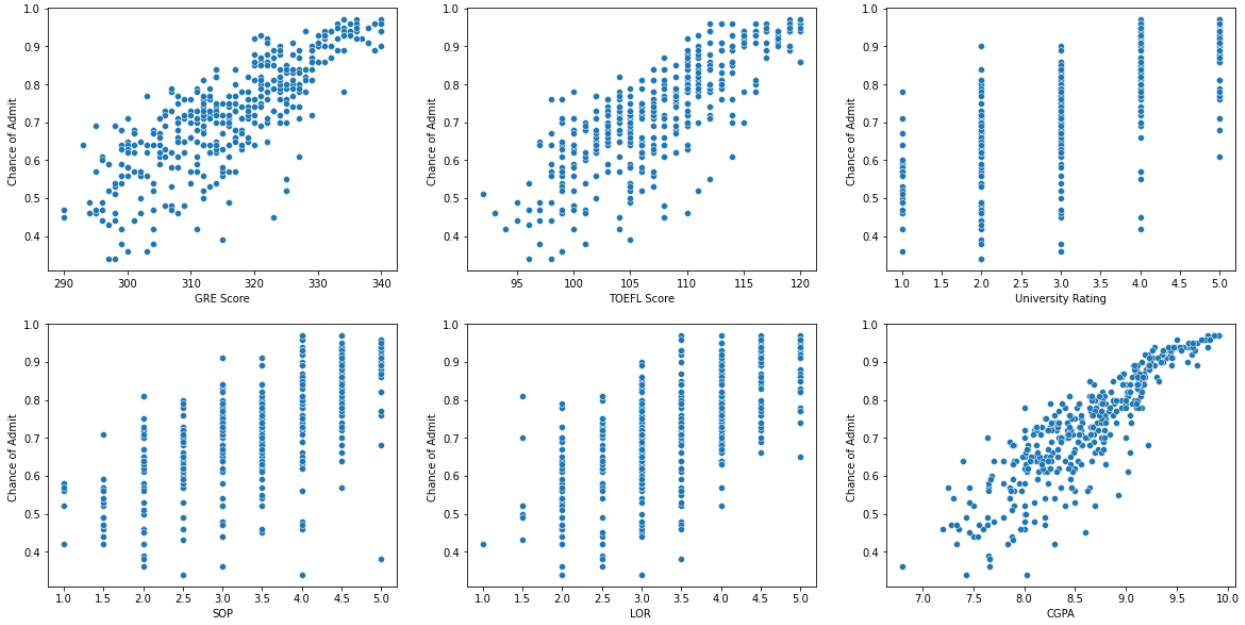
Continuous:

CGPA, Chance of Admit

Graphs

In [ ]:
```
colnames = ["GRE Score", "TOEFL Score", "University Rating", "SOP", "LOR ", "CGPA"]
fig, axs = plt.subplots(2, 3)
fig.set_size_inches(20,10)

for i in range(6):
    sns.scatterplot(data=df, y="Chance of Admit ", x=colnames[i], ax=np.ravel(axs)[i])
```



Шанс поступить на программу прямо пропорционально зависит от результатов GRE, TOEFL и CGPA. От остальных величин зависимость такая же, но менее выраженная

In [ ]:
```
random_state = 12345
powers = [0, 1, 2]

ans = []

for num_feats in range(1, 7):
    for combination in combinations(colnames, i):
        for pow in range(1, 3):
            X = df[list(combination)].to_numpy()
            if pow != 1:
                X = np.hstack((X, np.power(X, pow)))
            X_train, X_test, y_train, y_test = train_test_split(X, df["Chance of Admit "],
                                                    test_size=0.2, random_state=random_state)
            model = LinearRegression(n_jobs=-1)
            model.fit(X_train, y_train)
            y_pred = model.predict(X_test)
            ans.append({"feats": combination,
                "pow": pow,
                "r2_score": r2_score(y_test, y_pred),
                "mse_score": mean_squared_error(y_test, y_pred),
                "rss_score": mean_squared_error(y_test, y_pred) * y_pred.shape[0]})
```

Best by R2

In [ ]:
```
for res in sorted(ans, key=lambda x: -x["r2_score"])[:1]:
    print(f"Feats: {res['feats']}\nPow: {res['pow']}\nR2 score: {res['r2_score']}\n")
```

```
Feats: ('GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'CGPA')
Pow: 1
R2 score: 0.7198323290778955
```

Best by MSE

In [ ]:

```
for res in sorted(ans, key=lambda x: x["mse_score"])[:1]:
    print(f"Feats: {res['feats']}\nPow: {res['pow']}\nMSE score: {res['mse_score']}\n")
```

```
Feats: ('GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'CGPA')
Pow: 1
MSE score: 0.00462398792615515
```

Best by RSS

In [ ]:

```
for res in sorted(ans, key=lambda x: x["rss_score"])[:1]:
    print(f"Feats: {res['feats']}\nPow: {res['pow']}\nRSS score: {res['rss_score']}\n")
```

```
Feats: ('GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'CGPA')
Pow: 1
RSS score: 0.369919034092412
```

Линейная (по признакам) модель, использующая все признаки кроме LOR является самой сильной по всем выбранным метрикам. Скорее всего, LOR исключился во время регуляризации из-за большой корреляции с SOP (судя по графику)

In [ ]: