Competition Survey

Analyse important factors from past results of FS Electric competitions

Libraries

In [1]:
```
import pandas as pd

import os

import matplotlib.pyplot as plt
%config InlineBackend.figure_formats = ['svg'] # makes everything svg by default
%matplotlib inline

from sklearn import preprocessing
```

Importing Results

PDFs from FS Website

In [2]:
```
rel = "data/"
files = os.listdir("./data")
```

In [3]:
```
def read_file(file):
    if( ".csv" == file[-4:] ):
        df = pd.read_csv(rel + file)
        return df
```

In [4]:
```
raw_formula_student = pd.DataFrame()
for file in files:
    if( ".csv" == file[-4:] ):
        raw_formula_student = pd.concat(
            [raw_formula_student, read_file(file)]
        )
```

Data Cleanup

In [5]:
```
def cleanup(df):
    df = df.copy()
    df.dropna(inplace=True)
    df.iloc[:, 2:12] = (
        df.iloc[:, 2:12]
        .apply(lambda x: x.str.replace(',', '.'))
        .values.astype(float)
        )
    df[["Car", "Overall Placing"]] = df[["Car", "Overall Placing"]].values.astype('int32')
    df = df.set_index([
        "Competition",
        "City/University"
    ])
    return df

formula_student = raw_formula_student.pipe(cleanup)
formula_student
```

Out[5]:

Competition	City/University	Car	Cost	BPP	Design	ACC	SkidPad	AutoX	Endu	Effic	Penalties	Overall Scores	Overall Placing
FSG19	München TU	31	93.00	49.14	120.0	66.79	75.00	100.00	325.00	96.81	0.0	925.74	1
	Karlsruhe KIT	19	95.00	73.00	133.0	73.95	50.70	49.71	186.00	98.13	0.0	759.50	2
	Freiberg TU	85	88.00	52.58	100.0	46.19	37.19	62.84	229.71	95.19	0.0	711.70	3
	Aachen RWTH	99	92.00	74.00	115.0	58.39	12.41	48.89	205.64	93.74	0.0	700.07	4
	Eindhoven TU	40	98.00	62.18	95.0	37.69	52.09	34.52	175.01	89.24	65.0	578.73	5
...	...	...	...	...	...	...	...	...	...	...	...	...	...
FSG21	Chemnitz TU	36	77.90	57.86	55.0	0.00	0.00	0.00	0.00	0.00	30.0	160.76	34
	Berlin TU	113	79.80	52.61	55.0	0.00	0.00	0.00	0.00	0.00	35.0	152.41	35
	Ilmenau TU	71	61.75	45.43	60.0	0.00	0.00	0.00	0.00	0.00	18.0	149.18	36
	Lausanne EPFL	127	41.80	36.41	75.0	0.00	28.71	4.50	0.00	0.00	60.0	126.42	37
	Diepholz UAS	18	42.75	45.14	25.0	0.00	0.00	0.00	0.00	0.00	64.0	48.89	38

152 rows × 12 columns

Analysis

Overview

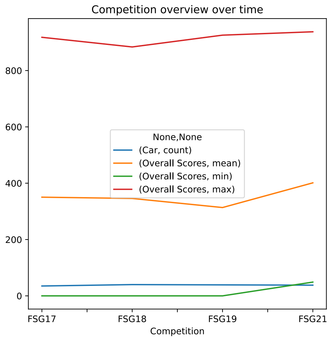
In [6]:
```
overview = (
    formula_student[["Car", "Overall Scores"]]
    .groupby(
        ["Competition"]
    )
    .agg({
        'Car' : ["count"],
        'Overall Scores' : ["mean", "min", "max"]
    })
    .round(1)
)

overview.plot(title="Competition overview over time", figsize=(6, 6))


overview
```

Out[6]:

	Car	Overall Scores		
	count	mean	min	max
Competition				
FSG17	35	350.4	0.0	918.1
FSG18	40	345.9	0.0	883.8
FSG19	39	313.6	0.0	925.7
FSG21	38	401.3	48.9	937.7



Importance of Evaluation Components

Using **correlation**, the components are sorted in descending order of their importance

In [7]:
```
(
    formula_student
    .iloc[:, 1:11]
    .corr()
    .rename(columns={"Overall Scores":"Correlation"})
    [["Correlation"]]
    .sort_values("Correlation", ascending=False)
    .iloc[1:, :] # remove the obvious overall scores = 1.00
)
```

Out[7]:

	Correlation
Endu	0.868175
Effic	0.811912
AutoX	0.777112
ACC	0.754784
Design	0.722782
SkidPad	0.708315
Cost	0.538074
BPP	0.458588
Penalties	-0.410896

Teams with best cost scores

We can learn how these teams managed to get such good positions

In [8]:
```
(
    formula_student[["Cost", "Overall Placing"]]
    .sort_values("Cost", ascending = False)
    .head(10)
    .sort_values("Overall Placing")
)
```

Out[8]:

Competition	City/University	Cost	Overall Placing
FSG21	Stuttgart U	99.0	1
FSG18	Karlsruhe KIT	100.0	4
FSG19	Eindhoven TU	98.0	5
FSG17	Karlsruhe KIT	100.0	6
FSG19	Stuttgart U	100.0	7
FSG17	Barcelona UPC	100.0	7
FSG21	Sankt Augustin UAS	100.0	8
FSG18	Delft TU	100.0	9
	Hamburg TU	99.0	17
FSG19	Schweinfurt UAS	99.0	24