Analysis Final for BMI520

Proof of concept of the Database and its potential uses downstream for analyses.

Connecting to the google SQL server is shamelessly ripped from this Link

Thanks @MattObusan for finding the link because I could not figure this out by myself.

```
!pip install "cloud-sql-python-connector[pymysql]"
!pip install "gcloud"
```

```
Requirement already satisfied: cloud-sql-python-connector[pymysql] in /usr/local/lib/python3.10/dist-packages (1.9.1)
Requirement already satisfied: aiohttp in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (3.9.5)
Requirement already satisfied: cryptography>=42.0.0 in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (42.0.5)
Requirement already satisfied: Requests in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (2.31.0)
Requirement already satisfied: google-auth>=2.28.0 in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (2.29.0)
Requirement already satisfied: PyMySQL>=1.1.0 in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (1.1.0)
Requirement already satisfied: cffi>=1.12 in /usr/local/lib/python3.10/dist-packages (from cryptography>=42.0.0->cloud-sql-python-connector[pymysql]) (1.16.0)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from google-auth>=2.28.0->cloud-sql-python-connector[pymysql]) (5.3.3)
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.10/dist-packages (from google-auth>=2.28.0->cloud-sql-python-connector[pymysql]) (0.4.0)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.10/dist-packages (from google-auth>=2.28.0->cloud-sql-python-connector[pymysql]) (4.9)
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (1.3.1)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (23.2.0)
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (1.4.1)
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (6.0.5)
Requirement already satisfied: yarl<2.0,>=1.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (1.9.4)
Requirement already satisfied: async-timeout<5.0,>=4.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (4.0.3)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (2024.2.2)
Requirement already satisfied: pycparser in /usr/local/lib/python3.10/dist-packages (from cffi>=1.12->cryptography>=42.0.0->cloud-sql-python-connector[pymysql]) (2.22)
Requirement already satisfied: pyasn1<0.7.0,>=0.4.6 in /usr/local/lib/python3.10/dist-packages (from pyasn1-modules>=0.2.1->google-auth>=2.28.0->cloud-sql-python-connector[pyr
Collecting gcloud
  Downloading gcloud-0.18.3.tar.gz (454 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 454.4/454.4 kB 5.6 MB/s eta 0:00:00
  Preparing metadata (setup.py) ... done
Requirement already satisfied: httplib2>=0.9.1 in /usr/local/lib/python3.10/dist-packages (from gcloud) (0.22.0)
Requirement already satisfied: googleapis-common-protos in /usr/local/lib/python3.10/dist-packages (from gcloud) (1.63.0)
Requirement already satisfied: oauth2client>=2.0.1 in /usr/local/lib/python3.10/dist-packages (from gcloud) (4.1.3)
Requirement already satisfied: protobuf!=3.0.0.b2.post1,>=3.0.0b2 in /usr/local/lib/python3.10/dist-packages (from gcloud) (3.20.3)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from gcloud) (1.16.0)
Requirement already satisfied: pyparsing!=3.0.0,!=3.0.1,!=3.0.2,!=3.0.3,<4,>=2.4.2 in /usr/local/lib/python3.10/dist-packages (from httplib2>=0.9.1->gcloud) (3.1.2)
Requirement already satisfied: pyasn1>=0.1.7 in /usr/local/lib/python3.10/dist-packages (from oauth2client>=2.0.1->gcloud) (0.6.0)
Requirement already satisfied: pyasn1-modules>=0.0.5 in /usr/local/lib/python3.10/dist-packages (from oauth2client>=2.0.1->gcloud) (0.4.0)
Requirement already satisfied: rsa>=3.1.4 in /usr/local/lib/python3.10/dist-packages (from oauth2client>=2.0.1->gcloud) (4.9)
Building wheels for collected packages: gcloud
```

```
  Building wheel for gcloud (setup.py) ... done
  Created wheel for gcloud: filename=gcloud-0.18.3-py3-none-any.whl size=602928 sha256=9b35c6c9b3134d1ea15287fdc0658bc206e96f9b4c61061582eb6108ea17eb3d
  Stored in directory: /root/.cache/pip/wheels/7c/30/88/5017af921da3a33af785f0d0fd3e944b845bc62a445a2c2f69
Successfully built gcloud
Installing collected packages: gcloud
Successfully installed gcloud-0.18.3
```

```
!gcloud auth login
!gcloud config set project [YOUR PROJECT ID]
!gcloud sql instances describe [YOUR CLOUDSQL INSTANCE ID]
```

```
from google.cloud.sql.connector import Connector
import sqlalchemy as sa
import pymysql
import pandas as pd
```

```
from google.colab import auth

auth.authenticate_user()
```

```
!gcloud config set project bmi520nbastatssql
```

```
Updated property [core/project].
```

```
current_user = !gcloud auth list --filter=status:ACTIVE --format="value(account)"

!gcloud projects add-iam-policy-binding bmi520nbastatssql \
  --member=user:{current_user[0]} \
  --role="roles/cloudsql.client"
```

```
Updated IAM policy for project [bmi520nbastatssql].
bindings:
- members:
  - serviceAccount:quickstart-service-account@bmi520nbastatssql.iam.gserviceaccount.com
  - user:Max.Longhao.Chao@gmail.com
  role: roles/cloudsql.client
- members:
  - serviceAccount:service-641611893501@compute-system.iam.gserviceaccount.com
  role: roles/compute.serviceAgent
- members:
  - serviceAccount:service-641611893501@gcp-sa-datamigration.iam.gserviceaccount.com
  role: roles/datamigration.serviceAgent
- members:
  - serviceAccount:641611893501-compute@developer.gserviceaccount.com
  - serviceAccount:641611893501@cloudservices.gserviceaccount.com
```

```
    role: roles/editor
  - members:
    - user:Max.Longhao.Chao@gmail.com
    role: roles/owner
  etag: BwYXLaWJcwQ=
  version: 1
```

```
!gcloud services enable sqladmin.googleapis.com
```

```
region = "us-central1"
instance_name = "nbastatsscrape"
database_version = !gcloud sql instances describe {instance_name} --format="value(databaseVersion)"
if database_version[0].startswith("MYSQL"):
  print("Found existing MySQL Cloud SQL Instance!")
else:
  print("Creating new Cloud SQL instance...")
  password = input("Please provide a password to be used for database 'root' user: ")
  !gcloud sql instances create {instance_name} --database-version=MYSQL_8_0 \
    --region={region} --cpu=1 --memory=4GB --root-password={password} \
    --database-flags=cloudsql_iam_authentication=On
```

```
  Found existing MySQL Cloud SQL Instance!
```

```
!gcloud sql databases create sandwiches --instance={instance_name}
```

```
  Created database [sandwiches].
  instance: nbastatsscrape
  name: sandwiches
  project: bmi520nbastatssql
```

```
!gcloud sql users create chef \
  --instance={instance_name} \
  --password="no"
```

```
  Created user [chef].
```

```
from google.colab import auth

auth.authenticate_user()
# install dependencies
import sys
!{sys.executable} -m pip install cloud-sql-python-connector["pymysql"] SQLAlchemy==2.0.7
```

```
Requirement already satisfied: cloud-sql-python-connector[pymysql] in /usr/local/lib/python3.10/dist-packages (1.9.1)
Collecting SQLAlchemy==2.0.7
  Downloading SQLAlchemy-2.0.7-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (2.7 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 2.7/2.7 MB 10.0 MB/s eta 0:00:00
Requirement already satisfied: typing-extensions>=4.2.0 in /usr/local/lib/python3.10/dist-packages (from SQLAlchemy==2.0.7) (4.11.0)
Requirement already satisfied: greenlet!=0.4.17 in /usr/local/lib/python3.10/dist-packages (from SQLAlchemy==2.0.7) (3.0.3)
Requirement already satisfied: aiohttp in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (3.9.5)
Requirement already satisfied: cryptography>=42.0.0 in /usr/local/lib/python3.10/dist-packages (from cloud-sql-python-connector[pymysql]) (42.0.5)
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Requirement already satisfied: cffi>=1.12 in /usr/local/lib/python3.10/dist-packages (from cryptography>=42.0.0->cloud-sql-python-connector[pymysql]) (1.16.0)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from google-auth>=2.28.0->cloud-sql-python-connector[pymysql]) (5.3.3)
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Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.10/dist-packages (from google-auth>=2.28.0->cloud-sql-python-connector[pymysql]) (4.9)
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (1.3.1)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (23.2.0)
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (1.4.1)
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (6.0.5)
Requirement already satisfied: yarl<2.0,>=1.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (1.9.4)
Requirement already satisfied: async-timeout<5.0,>=4.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->cloud-sql-python-connector[pymysql]) (4.0.3)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from Requests->cloud-sql-python-connector[pymysql]) (2024.2.2)
Requirement already satisfied: pycparser in /usr/local/lib/python3.10/dist-packages (from cffi>=1.12->cryptography>=42.0.0->cloud-sql-python-connector[pymysql]) (2.22)
Requirement already satisfied: pyasn1<0.7.0,>=0.4.6 in /usr/local/lib/python3.10/dist-packages (from pyasn1-modules>=0.2.1->google-auth>=2.28.0->cloud-sql-python-connector[pym
Installing collected packages: SQLAlchemy
  Attempting uninstall: SQLAlchemy
    Found existing installation: SQLAlchemy 2.0.29
    Uninstalling SQLAlchemy-2.0.29:
      Successfully uninstalled SQLAlchemy-2.0.29
Successfully installed SQLAlchemy-2.0.7
```

```
# initialize parameters
INSTANCE_CONNECTION_NAME = f"bmi520nbastatssql:us-central1:nbastatsscrape" # i.e demo-project:us-central1:demo-instance
print(f"Your instance connection name is: {INSTANCE_CONNECTION_NAME}")
DB_USER = "chef"
DB_PASS = "no"
DB_NAME = "NBAPlayerStats2023_24"
```

```
Your instance connection name is: bmi520nbastatssql:us-central1:nbastatsscrape
```

```
from google.cloud.sql.connector import Connector
import sqlalchemy

# initialize Connector object
connector = Connector()

# function to return the database connection object
def getconn():
    conn = connector.connect(
        INSTANCE_CONNECTION_NAME,
        "pymysql",
        user=DB_USER,
        password=DB_PASS,
        db=DB_NAME
    )
    return conn

# create connection pool with 'creator' argument to our connection object function
pool = sqlalchemy.create_engine(
    "mysql+pymysql://",
    creator=getconn,
)
```

```
connection = pool.connect()
```

```
q = """SHOW TABLES"""
t=pd.read_sql(sa.text(q), connection)
t
```

	Tables_in_NBAPlayerStats2023_24
0	advanced
1	defense
2	est_advanced
3	misc
4	opponent
5	player_usage
6	players
7	scoring
8	traditional
9	usage

Next steps: Generate code with t View recommended plots

```
for i in t['Tables_in_NBAPlayerStats2023_24'][:-1]:
  q="SHOW COLUMNS FROM " + i
  print(i)
  print(pd.read_sql(sa.text(q), connection))
#done
```

```
advanced
        Field    Type Null Key Default Extra
0          ID  bigint  YES        None
1      PLAYER    text  YES        None
2        TEAM    text  YES        None
3         AGE  bigint  YES        None
4          GP  bigint  YES        None
5           W  bigint  YES        None
6           L  bigint  YES        None
7         MIN  double  YES        None
8      OFFRTG  double  YES        None
9      DEFRTG  double  YES        None
10     NETRTG  double  YES        None
11       ASTP  double  YES        None
12     AST_TO  double  YES        None
13  AST_RATIO  double  YES        None
14      OREBP  double  YES        None
15      DREBP  double  YES        None
16       REBP  double  YES        None
```

```
17   TO_RATIO  double  YES        None
18       EFGP  double  YES        None
19        TSP  double  YES        None
20       USGP  double  YES        None
21       PACE  double  YES        None
22        PIE  double  YES        None
23       POSS  bigint  YES        None
defense
                 Field    Type Null Key Default Extra
0                   ID  bigint  YES        None
1               PLAYER    text  YES        None
2                 TEAM    text  YES        None
3                  AGE  bigint  YES        None
4                   GP  bigint  YES        None
5                    W  bigint  YES        None
6                    L  bigint  YES        None
7                  MIN  double  YES        None
8              DEF_RTG  double  YES        None
9                 DREB  double  YES        None
10            DREB_PCT  double  YES        None
11       DREB_PCT_TEAM  double  YES        None
12                 STL  double  YES        None
13             STL_PCT  double  YES        None
14                 BLK  double  YES        None
15             BLK_PCT  double  YES        None
16     OPP_PTS/OFF_TOV  double  YES        None
17  OPP_PTS_2ND_CHANCE  double  YES        None
18          OPP_PTS_FB  double  YES        None
19       OPP_PTS_PAINT  double  YES        None
20              DEF_WS  double  YES        None
est_advanced
            Field    Type Null Key Default Extra
0              ID  bigint  YES        None
1          PLAYER    text  YES        None
2              GP  bigint  YES        None
3               W  bigint  YES        None
4               L  bigint  YES        None
5             MIN  bigint  YES        None
```

```
q = """SELECT * FROM players LIMIT 10"""
pd.read_sql(sa.text(q), connection)
```

	ID	PLAYER	TEAM	AGE	HEIGHT	WEIGHT
0	1	A.J. Lawson	DAL	23	198.12	179
1	2	AJ Green	MIL	24	193.04	190
2	3	AJ Griffin	ATL	20	198.12	220
3	4	Aaron Gordon	DEN	28	203.20	235
4	5	Aaron Holiday	HOU	27	182.88	185
5	6	Aaron Nesmith	IND	24	198.12	215
6	7	Aaron Wiggins	OKC	25	195.58	190
7	8	Adam Flagler	OKC	24	190.50	180
8	9	Adama Sanogo	CHI	22	205.74	245
9	10	Admiral Schofield	ORL	26	195.58	241

```
q = """SELECT * FROM traditional LIMIT 10"""
pd.read_sql(sa.text(q), connection)
```

	ID	PLAYER	TEAM	AGE	GP	W	L	MIN	PTS	FGM	...	REB	AST	TOV	STL	BLK	PF	FP	DD2	TD3	plus_minus
0	1	A.J. Lawson	DAL	23	30	17	13	7.9	3.6	1.4	...	1.1	0.4	0.3	0.3	0.1	0.6	6.5	0.0	0.0	0.9
1	2	AJ Green	MIL	24	42	29	13	9.6	4.3	1.5	...	1.1	0.6	0.2	0.1	0.0	0.9	6.7	0.0	0.0	0.2
2	3	AJ Griffin	ATL	20	18	8	10	7.4	2.1	0.7	...	0.8	0.2	0.3	0.1	0.1	0.3	3.3	0.0	0.0	-1.6
3	4	Aaron Gordon	DEN	28	58	39	19	31.4	13.8	5.5	...	6.5	3.2	1.5	0.9	0.6	1.9	29.4	10.0	0.0	5.6
4	5	Aaron Holiday	HOU	27	61	28	33	16.5	6.6	2.4	...	1.7	1.8	0.7	0.5	0.1	1.5	12.3	0.0	0.0	0.9
5	6	Aaron Nesmith	IND	24	56	31	25	27.1	12.3	4.4	...	3.8	1.4	0.9	1.0	0.7	3.3	23.1	1.0	0.0	1.3
6	7	Aaron Wiggins	OKC	25	61	44	17	14.6	6.2	2.4	...	2.3	0.9	0.6	0.6	0.2	1.1	12.1	0.0	0.0	0.7
7	8	Adam Flagler	OKC	24	1	1	0	5.5	0.0	0.0	...	0.0	1.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
8	9	Adama Sanogo	CHI	22	3	0	3	3.5	2.7	1.0	...	2.0	0.0	0.3	0.0	0.0	0.0	4.7	0.0	0.0	5.7
9	10	Admiral Schofield	ORL	26	16	9	7	3.5	0.9	0.4	...	0.6	0.3	0.3	0.0	0.0	0.4	1.9	0.0	0.0	0.6

10 rows × 30 columns

```
q = """SELECT DISTINCT p.AGE, p.HEIGHT, p.WEIGHT, t.PTS, t.PLAYER, t.ID FROM traditional t
       JOIN players p on t.id = p.id"""
trad_stats = pd.read_sql(sa.text(q), connection)
# basic grab joining player with traditional
```

```
trad_stats
```

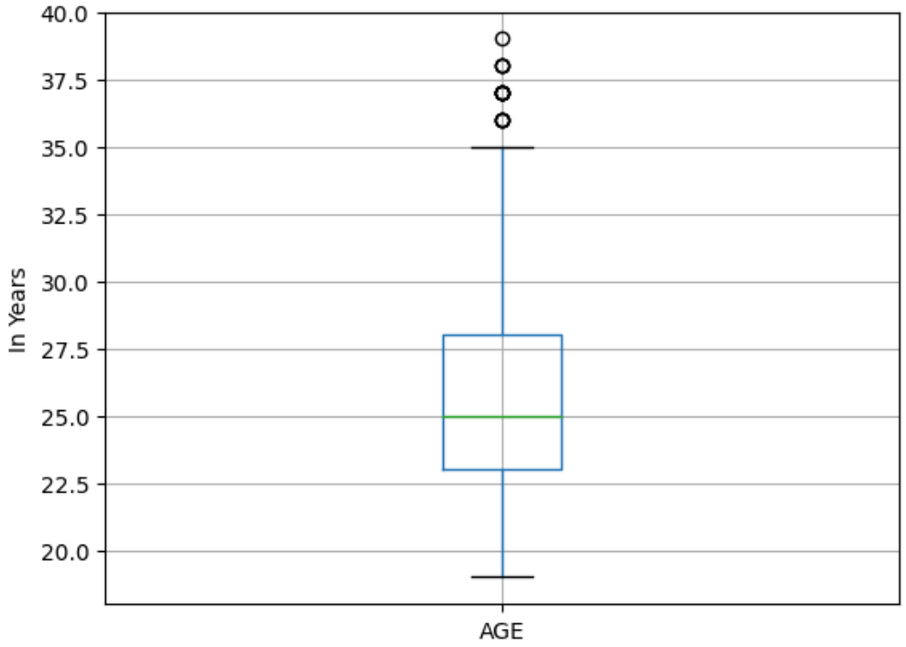
	AGE	HEIGHT	WEIGHT	PTS	PLAYER	ID
0	23	198.12	179	3.6	A.J. Lawson	1
1	24	193.04	190	4.3	AJ Green	2
2	20	198.12	220	2.1	AJ Griffin	3
3	28	203.20	235	13.8	Aaron Gordon	4
4	27	182.88	185	6.6	Aaron Holiday	5
...	...	...	...	...	...	...
549	26	210.82	250	11.4	Zach Collins	550
550	29	195.58	200	19.5	Zach LaVine	551
551	23	205.74	240	3.2	Zeke Nnaji	552
552	22	205.74	185	8.2	Ziaire Williams	553
553	23	198.12	284	22.1	Zion Williamson	554

554 rows × 6 columns

Next steps: Generate code with `trad_stats` View recommended plots

```
import matplotlib.pyplot as plt
#grab basic information about age height and weight.
trad_stats[['AGE']].boxplot()
plt.title(print('Age of ' + str(trad_stats.shape[0])+' Players in the NBA 23/24 Season'))
plt.ylabel('In Years')
plt.show()
# box plots
```

Age of 554 Players in the NBA 23/24 Season



Generate

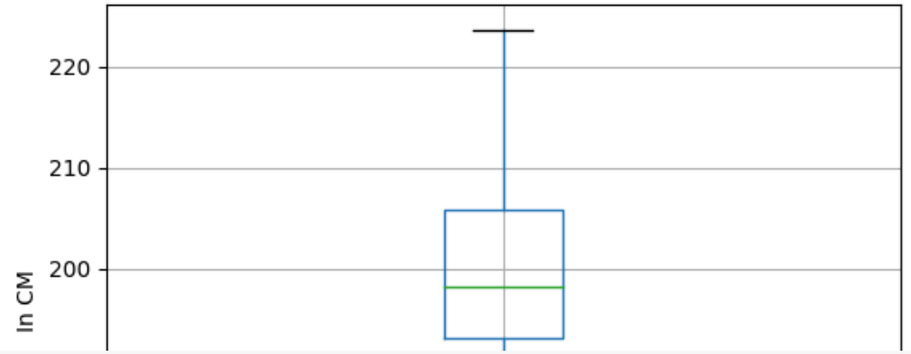
10 random numbers using numpy

Close

Generate is available for a limited time for unsubscribed users. Upgrade to Colab Pro

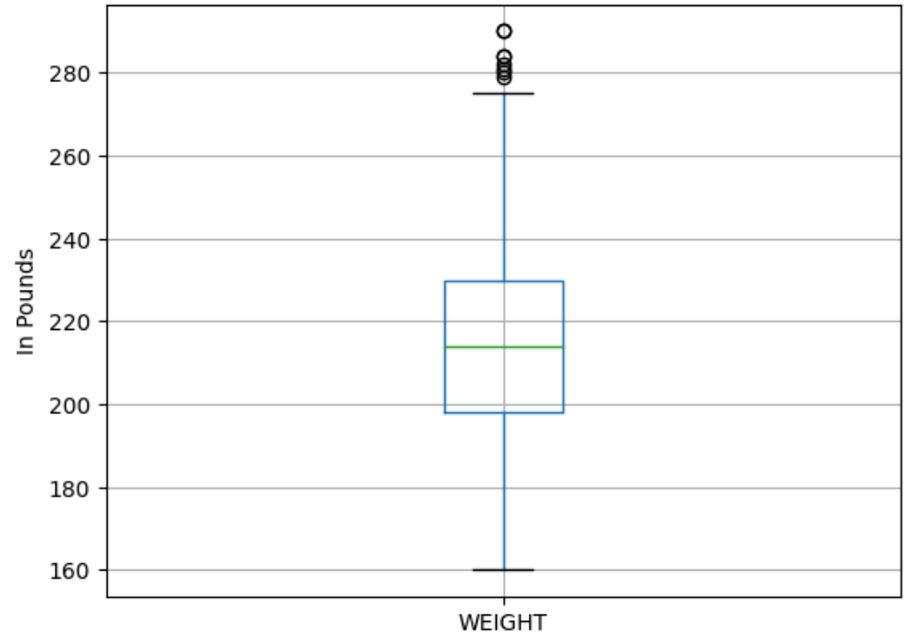
```
trad_stats[['HEIGHT']].boxplot()
plt.title(print('Height of ' + str(trad_stats.shape[0])+' Players in the NBA 23/24 Season'))
plt.ylabel('In CM')
plt.show()
```

Height of 554 Players in the NBA 23/24 Season




```
trad_stats[['WEIGHT']].boxplot()
plt.title(print('WEIGHT of ' + str(trad_stats.shape[0])+' Players in the NBA 23/24 Season'))
plt.ylabel('In Pounds')
plt.show()
```

WEIGHT of 554 Players in the NBA 23/24 Season

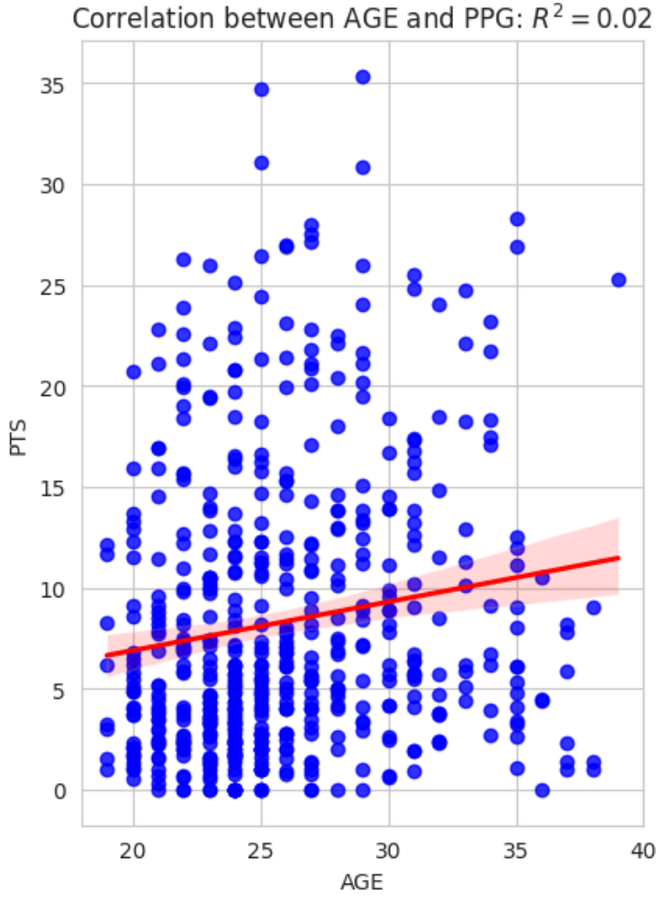


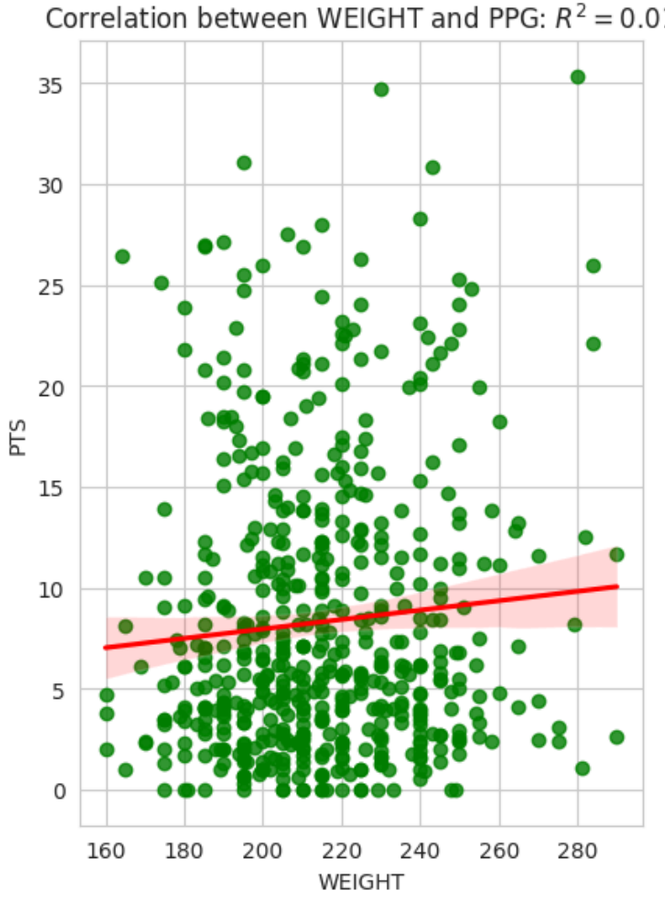

```
trad_stats[['AGE', 'HEIGHT','WEIGHT']].describe()
```

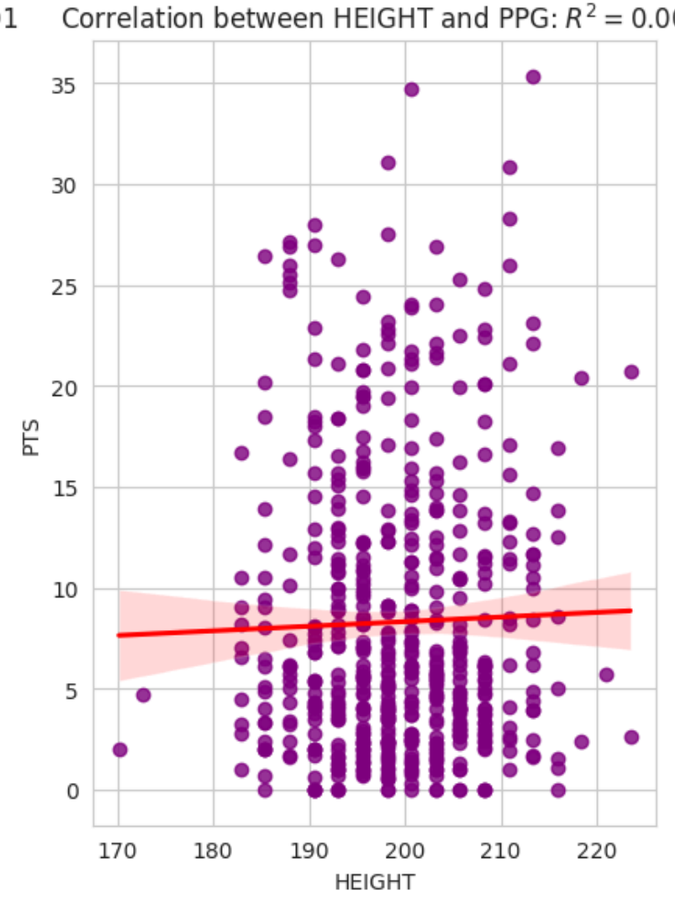
	AGE	HEIGHT	WEIGHT
count	554.000000	554.000000	554.000000
mean	25.866426	199.188267	214.810469
std	4.250756	8.000900	23.753979
min	19.000000	170.180000	160.000000
25%	23.000000	193.040000	198.000000
50%	25.000000	198.120000	214.000000
75%	28.000000	205.740000	230.000000
max	39.000000	223.520000	290.000000

Correlation Plots

```
# how to these 3 physiological features correlate to PPG?
import seaborn as sns
import scipy as sp

import statsmodels.api as sm
# include R2
def calculate_r_squared(df, x_col, y_col):
    """Calculate R-squared for columns x_col and y_col in dataframe df."""
    X = df[x_col]
    X = sm.add_constant(X)  # adding a constant for the intercept
    Y = df[y_col]

    model = sm.OLS(Y, X).fit()
    return model.rsquared

# get R2 for all three:
ager =calculate_r_squared(trad_stats, 'AGE', 'PTS')
wr =calculate_r_squared(trad_stats, 'WEIGHT', 'PTS')
hr =calculate_r_squared(trad_stats, 'HEIGHT', 'PTS')
sns.set_style("whitegrid")

# Create a figure with subplots
plt.figure(figsize=(13, 6))

# Plot for Column1 vs Column3
plt.subplot(1, 3, 1)  # 1 row, 2 columns, 1st subplot
sns.regplot(x='AGE', y='PTS', data=trad_stats, scatter_kws={"color": "blue"}, line_kws={"color": "red"})
plt.title(f'Correlation between AGE and PPG: $R^2={ager:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 2)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='WEIGHT', y='PTS', data=trad_stats, scatter_kws={"color": "green"}, line_kws={"color": "red"})
plt.title(f'Correlation between WEIGHT and PPG: $R^2={wr:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 3)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='HEIGHT', y='PTS', data=trad_stats, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Correlation between HEIGHT and PPG: $R^2={hr:.2f}$')

# Display the plots
plt.tight_layout()
plt.show()
```








```
# sort by ppg
trad_stats.sort_values(by='PTS', ascending=False)
```

	AGE	HEIGHT	WEIGHT	PTS	PLAYER	ID
273	29	213.36	280	35.3	Joel Embiid	274
361	25	200.66	230	34.7	Luka Doncic	362
486	25	198.12	195	31.1	Shai Gilgeous-Alexander	487
179	29	210.82	243	30.8	Giannis Antetokounmpo	180
327	35	210.82	240	28.3	Kevin Durant	328
...	...	...	...	...	...	...
252	24	193.04	205	0.0	Javonte Smart	253
250	24	190.50	181	0.0	Jason Preston	251
471	29	190.50	195	0.0	Ryan Arcidiacono	472
225	24	185.42	175	0.0	Jalen Crutcher	226
308	28	203.20	220	0.0	Justin Jackson	309

554 rows × 6 columns

```
# now lets take players who actually get real minutes a game
q = """SELECT DISTINCT p.AGE, p.HEIGHT, p.WEIGHT, t.PTS, t.PLAYER, t.ID, t.MIN FROM traditional t
       JOIN players p on t.id = p.id WHERE MIN > 15"""
trad_stats_min = pd.read_sql(sa.text(q), connection)
```

```
# filter for players more than 15 minutes
trad_stats_min
```

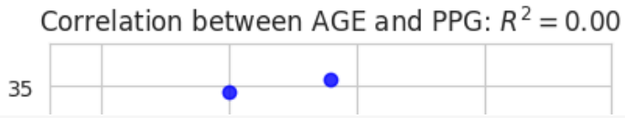
	AGE	HEIGHT	WEIGHT	PTS	PLAYER	ID	MIN
0	28	203.20	235	13.8	Aaron Gordon	4	31.4
1	27	182.88	185	6.6	Aaron Holiday	5	16.5
2	24	198.12	215	12.3	Aaron Nesmith	6	27.1
3	37	205.74	240	7.8	Al Horford	11	26.7
4	32	195.58	214	11.5	Alec Burks	12	19.7
...	...	...	...	...	...	...	...
306	25	200.66	245	5.8	Xavier Tillman	548	19.7
307	26	210.82	250	11.4	Zach Collins	550	23.3
308	29	195.58	200	19.5	Zach LaVine	551	34.9
309	22	205.74	185	8.2	Ziaire Williams	553	20.3
310	23	198.12	284	22.1	Zion Williamson	554	30.7

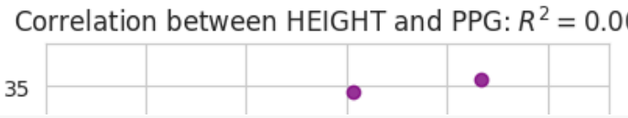
311 rows × 7 columns

Next steps: Generate code with `trad_stats_min` View recommended plots

Generate randomly select 5 items from a list Close

```
# include R2
def calculate_r_squared(df, x_col, y_col):
    """Calculate R-squared for columns x_col and y_col in dataframe df."""
    X = df[x_col]
    X = sm.add_constant(X)  # adding a constant for the intercept
    Y = df[y_col]

    model = sm.OLS(Y, X).fit()
    return model.rsquared

# get R2 for all three:
ager =calculate_r_squared(trad_stats_min, 'AGE', 'PTS')
wr =calculate_r_squared(trad_stats_min, 'WEIGHT', 'PTS')
hr =calculate_r_squared(trad_stats_min, 'HEIGHT', 'PTS')
sns.set_style("whitegrid")

# Create a figure with subplots
plt.figure(figsize=(13, 6))

# Plot for Column1 vs Column3
plt.subplot(1, 3, 1)  # 1 row, 2 columns, 1st subplot
sns.regplot(x='AGE', y='PTS', data=trad_stats_min, scatter_kws={"color": "blue"}, line_kws={"color": "red"})
plt.title(f'Correlation between AGE and PPG: $R^2={ager:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 2)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='WEIGHT', y='PTS', data=trad_stats_min, scatter_kws={"color": "green"}, line_kws={"color": "red"})
plt.title(f'Correlation between WEIGHT and PPG: $R^2={wr:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 3)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='HEIGHT', y='PTS', data=trad_stats_min, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Correlation between HEIGHT and PPG: $R^2={hr:.2f}$')

# Display the plots
plt.tight_layout()
plt.show()
```

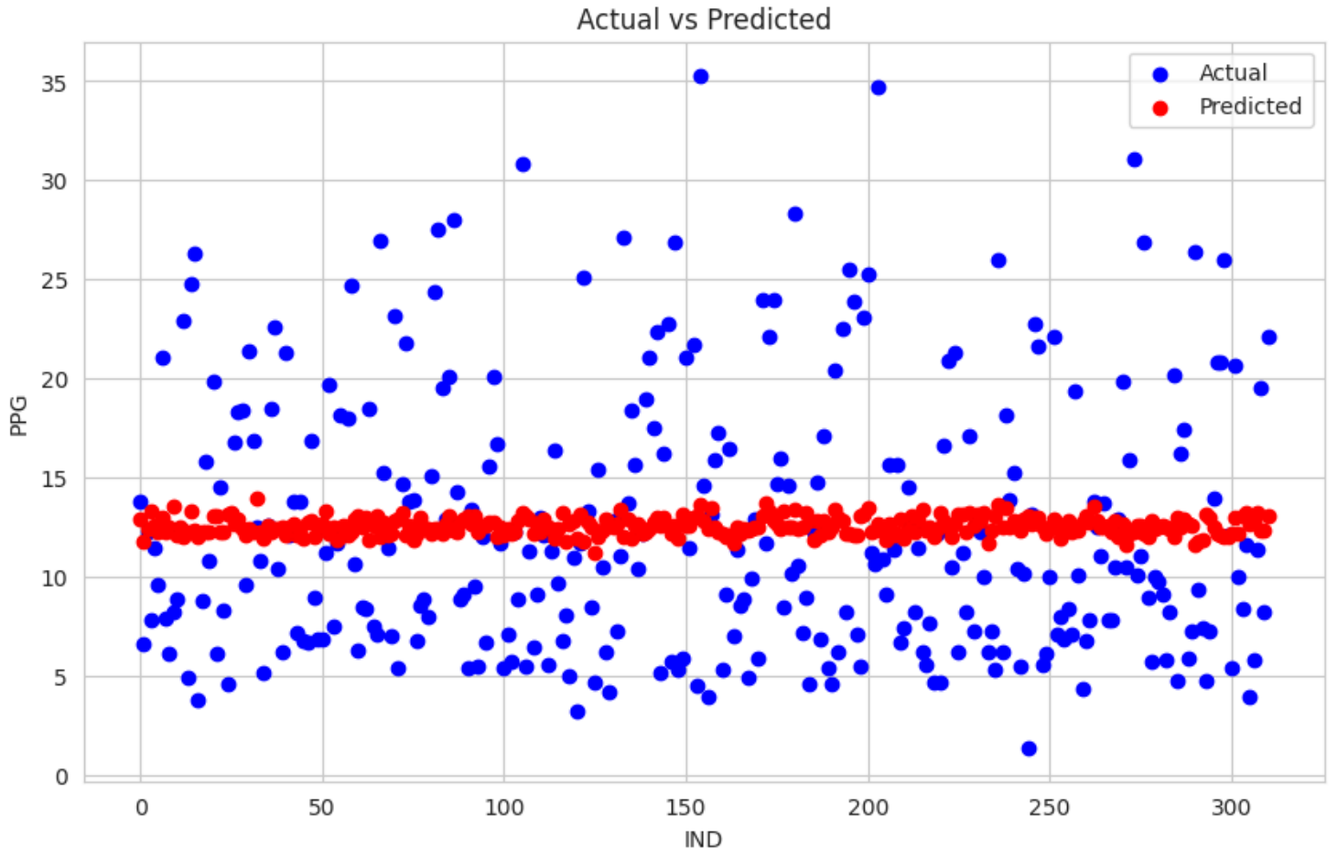





```
import numpy as np
# linear regresssion of stats on PPG
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split

# Define the independent and dependent variables
X = trad_stats_min[['AGE', 'HEIGHT', 'WEIGHT']]  # independent variables
y = trad_stats_min['PTS']  # dependent variable

# create split
X_train, X_test, y_train, y_test = train_test_split(X,y,
                                    random_state=104,
                                    test_size=0.2,
                                    shuffle=True)


# Create a linear regression model instance
model = LinearRegression()

# Fit the model
model.fit(X, y)

# Display the coefficients
print("Coefficients:", model.coef_)
print("Intercept:", model.intercept_)

# Use the model to make predictions
y_pred = model.predict(X)
```

```
Coefficients: [0.03029436 0.02871136 0.00942682]
Intercept: 4.013763128728835
```

```
plt.figure(figsize=(10, 6))
plt.scatter(range(len(y)), y, color='blue', label='Actual')
plt.scatter(range(len(y)), y_pred, color='red', label='Predicted')
plt.title('Actual vs Predicted')
plt.xlabel('IND')
plt.ylabel('PPG')
plt.legend()
plt.show()
```




```
len(y)
```

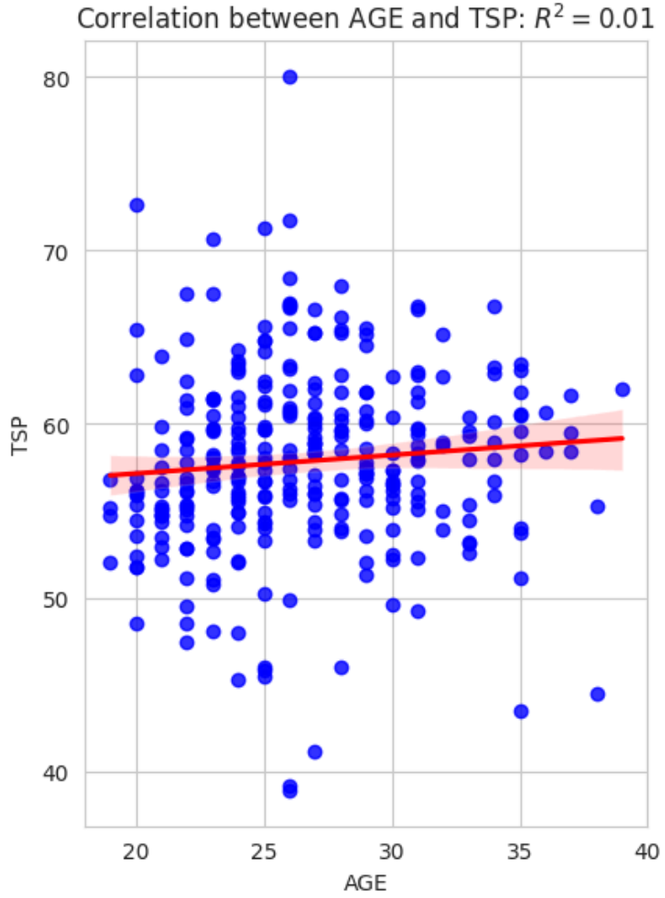
```
311
```

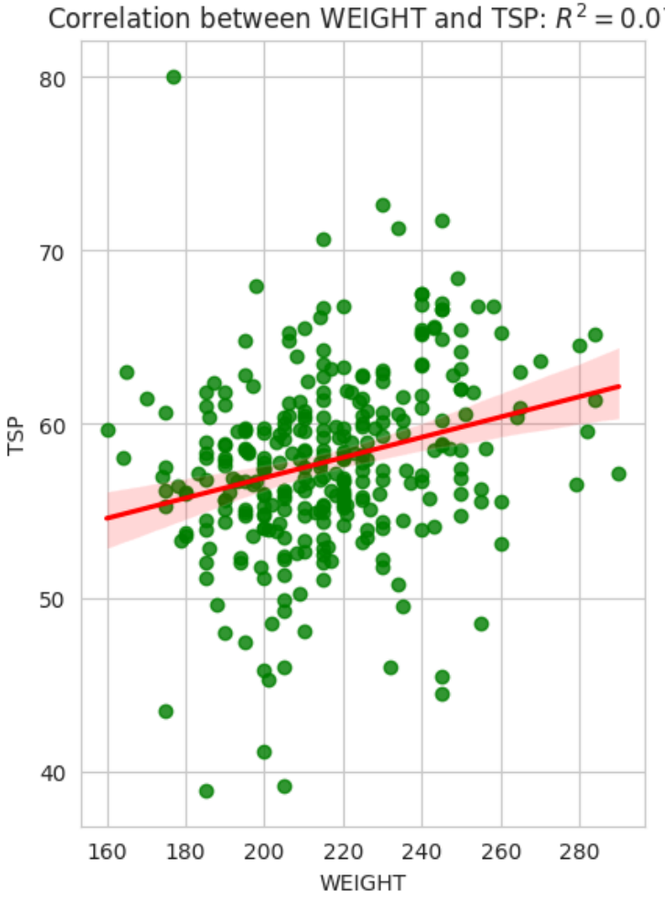
Looking into Player Efficiency

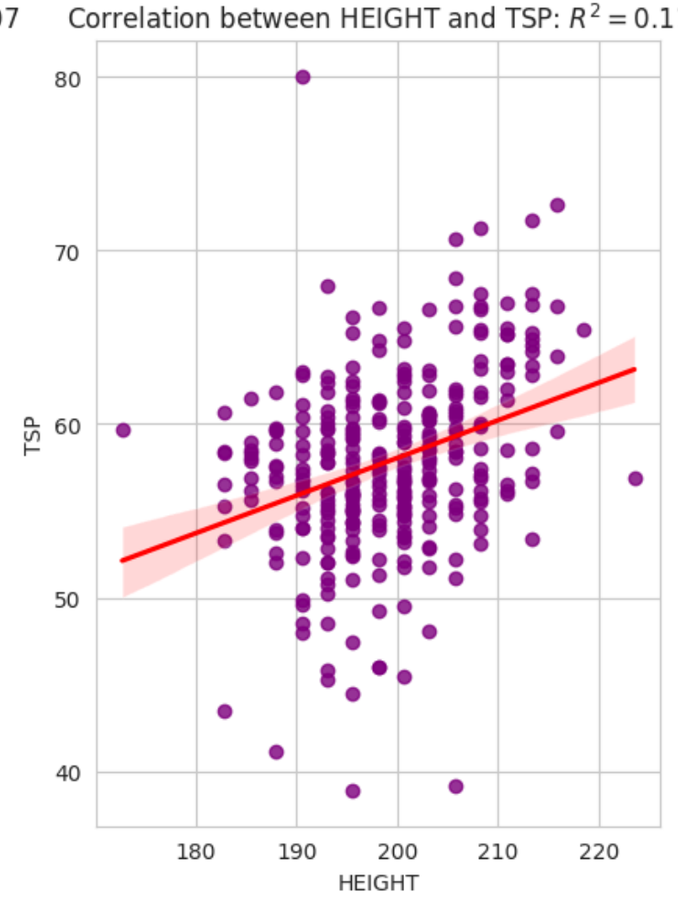
Looking at True shooting percentage: how well a player shoots per shot attempt

```
# now lets take players who actually get real minutes a game
# and player efficiency stats: Want TSP and USGP
q = """SELECT DISTINCT p.AGE, p.HEIGHT, p.WEIGHT, a.TSP, a.USGP, a.EFGP, a.ID, a.MIN FROM advanced a
       JOIN players p on a.id = p.id WHERE MIN > 15"""
advanced_stat_min = pd.read_sql(sa.text(q), connection)
```

```
# include R2
def calculate_r_squared(df, x_col, y_col):
    """Calculate R-squared for columns x_col and y_col in dataframe df."""
    X = df[x_col]
    X = sm.add_constant(X)  # adding a constant for the intercept
    Y = df[y_col]

    model = sm.OLS(Y, X).fit()
    return model.rsquared

# get R2 for all three:
ager =calculate_r_squared(advanced_stat_min, 'AGE', 'TSP')
wr =calculate_r_squared(advanced_stat_min, 'WEIGHT', 'TSP')
hr =calculate_r_squared(advanced_stat_min, 'HEIGHT', 'TSP')
sns.set_style("whitegrid")

# Create a figure with subplots
plt.figure(figsize=(13, 6))

# Plot for Column1 vs Column3
plt.subplot(1, 3, 1)  # 1 row, 2 columns, 1st subplot
sns.regplot(x='AGE', y='TSP', data=advanced_stat_min, scatter_kws={"color": "blue"}, line_kws={"color": "red"})
plt.title(f'Correlation between AGE and TSP: $R^2={ager:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 2)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='WEIGHT', y='TSP', data=advanced_stat_min, scatter_kws={"color": "green"}, line_kws={"color": "red"})
plt.title(f'Correlation between WEIGHT and TSP: $R^2={wr:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 3)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='HEIGHT', y='TSP', data=advanced_stat_min, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Correlation between HEIGHT and TSP: $R^2={hr:.2f}$')

# Display the plots
plt.tight_layout()
plt.show()
```


Correlation between AGE and TSP: $R^2 = 0.01$
TSP
AGE
80
70
60
50
40
20
25
30
35
40


Correlation between WEIGHT and TSP: $R^2 = 0.07$
TSP
WEIGHT
80
70
60
50
40
160
180
200
220
240
260
280


Correlation between HEIGHT and TSP: $R^2 = 0.11$
TSP
HEIGHT
80
70
60
50
40
180
190
200
210
220

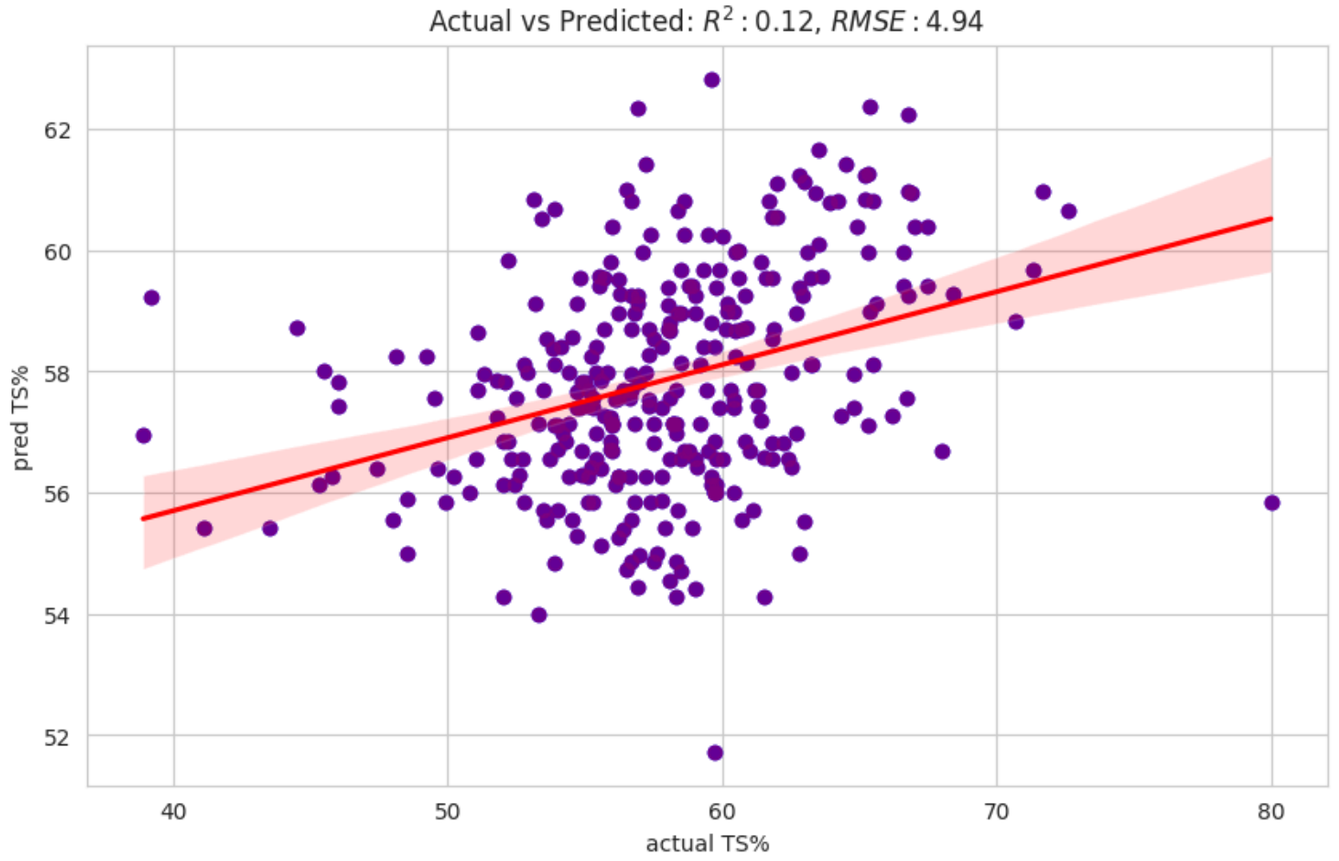
```
# Define the independent and dependent variables
X = advanced_stat_min[['AGE', 'HEIGHT', 'WEIGHT']]  # independent variables
y = advanced_stat_min['TSP']  # dependent variable

# create split
X_train, X_test, y_train, y_test = train_test_split(X,y,
                                    random_state=104,
                                    test_size=0.2,
                                    shuffle=True)


# Create a linear regression model instance
model = LinearRegression()

# Fit the model
model.fit(X, y)

# Display the coefficients
print("Coefficients:", model.coef_)
print("Intercept:", model.intercept_)

# Use the model to make predictions
y_pred = model.predict(X)
```

```
    Coefficients: [0.14173686 0.22211302 0.00076942]
    Intercept: 9.694422608392479
```

```
from sklearn.metrics import mean_squared_error, r2_score

# Calculate MSE
mse = mean_squared_error(y, y_pred)
print("Mean Squared Error (MSE):", mse)

# Calculate RMSE
rmse = np.sqrt(mse)
print("Root Mean Squared Error (RMSE):", rmse)


# Calculate R-squared (R^2)
r2 = r2_score(y, y_pred)
print("R-squared (R^2):", r2)
```

```
    Mean Squared Error (MSE): 24.385834320148867
    Root Mean Squared Error (RMSE): 4.938201526886976
    R-squared (R^2): 0.12040840958919907
```

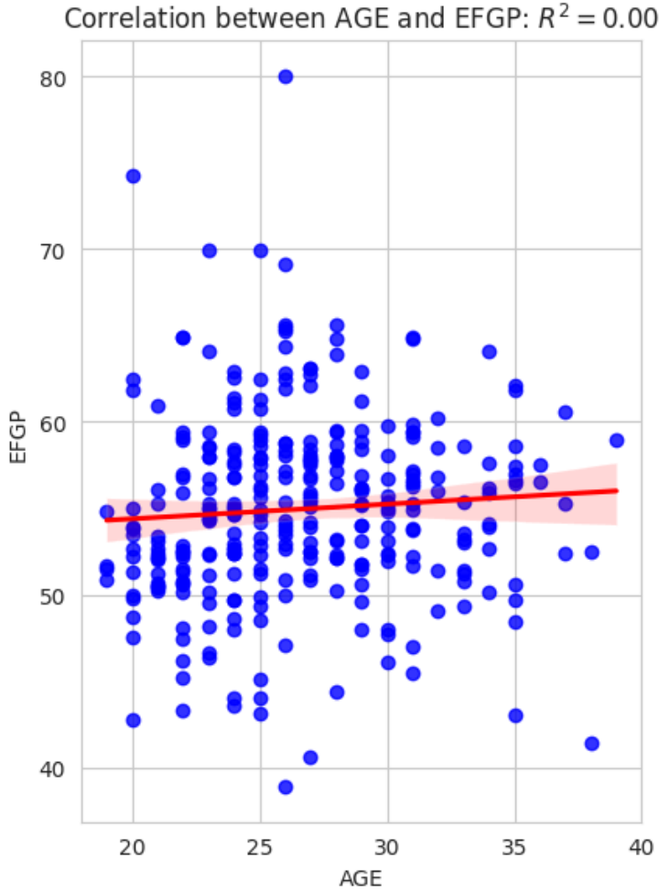
```
#goodness of fit of predicted vs actual
plt.figure(figsize=(10, 6))
plt.scatter(y, y_pred, color='blue')
sns.regplot(x=y, y=y_pred, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Actual vs Predicted: $R^2:{r2:.2f}$, $RMSE: {rmse:.2f}$')
plt.xlabel('actual TS%')
plt.ylabel('pred TS%')
plt.show()
```

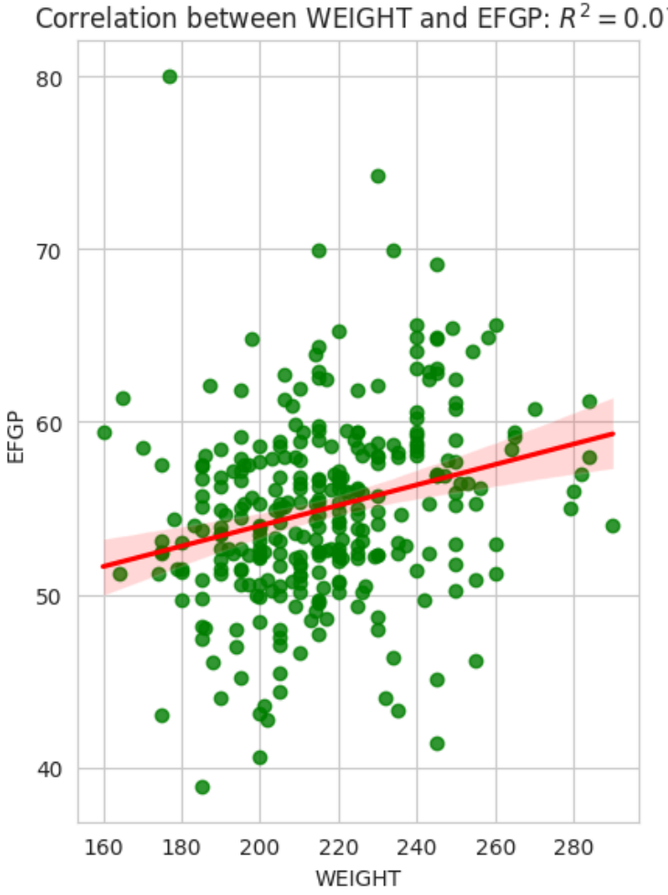


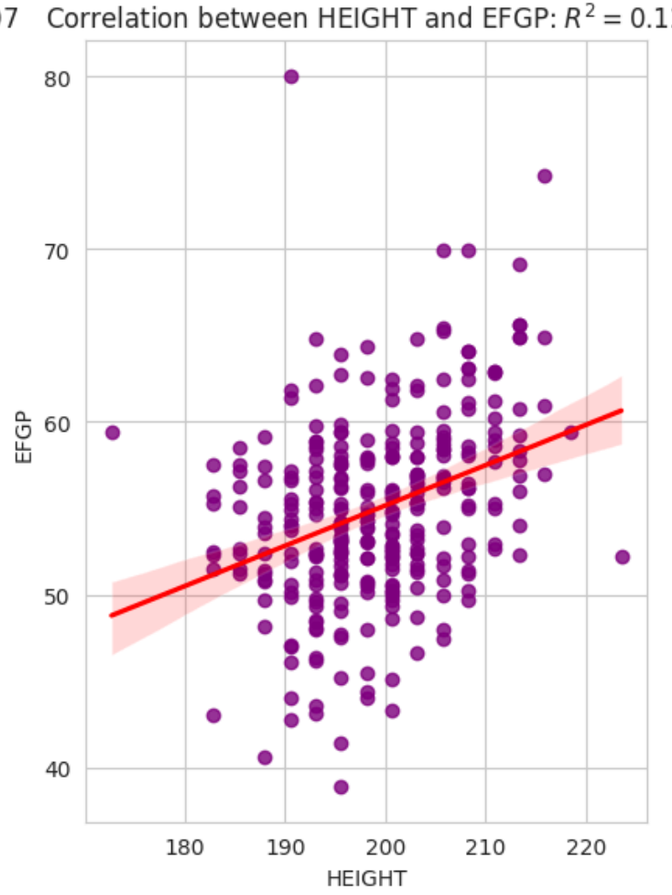
EFGP

stats

```
# include R2
def calculate_r_squared(df, x_col, y_col):
    """Calculate R-squared for columns x_col and y_col in dataframe df."""
    X = df[x_col]
    X = sm.add_constant(X)  # adding a constant for the intercept
    Y = df[y_col]

    model = sm.OLS(Y, X).fit()
    return model.rsquared

# get R2 for all three:
ager =calculate_r_squared(advanced_stat_min, 'AGE', 'EFGP')
wr =calculate_r_squared(advanced_stat_min, 'WEIGHT', 'EFGP')
hr =calculate_r_squared(advanced_stat_min, 'HEIGHT', 'EFGP')
sns.set_style("whitegrid")

# Create a figure with subplots
plt.figure(figsize=(13, 6))

# Plot for Column1 vs Column3
plt.subplot(1, 3, 1)  # 1 row, 2 columns, 1st subplot
sns.regplot(x='AGE', y='EFGP', data=advanced_stat_min, scatter_kws={"color": "blue"}, line_kws={"color": "red"})
plt.title(f'Correlation between AGE and EFGP: $R^2={ager:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 2)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='WEIGHT', y='EFGP', data=advanced_stat_min, scatter_kws={"color": "green"}, line_kws={"color": "red"})
plt.title(f'Correlation between WEIGHT and EFGP: $R^2={wr:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 3)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='HEIGHT', y='EFGP', data=advanced_stat_min, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Correlation between HEIGHT and EFGP: $R^2={hr:.2f}$')

# Display the plots
plt.tight_layout()
plt.show()
```


Correlation between AGE and EFGP: $R^2 = 0.00$
EFGP
AGE
80
70
60
50
40
20
25
30
35
40


Correlation between WEIGHT and EFGP: $R^2 = 0.07$
EFGP
WEIGHT
80
70
60
50
40
160
180
200
220
240
260
280


Correlation between HEIGHT and EFGP: $R^2 = 0.12$
EFGP
HEIGHT
80
70
60
50
40
180
190
200
210
220

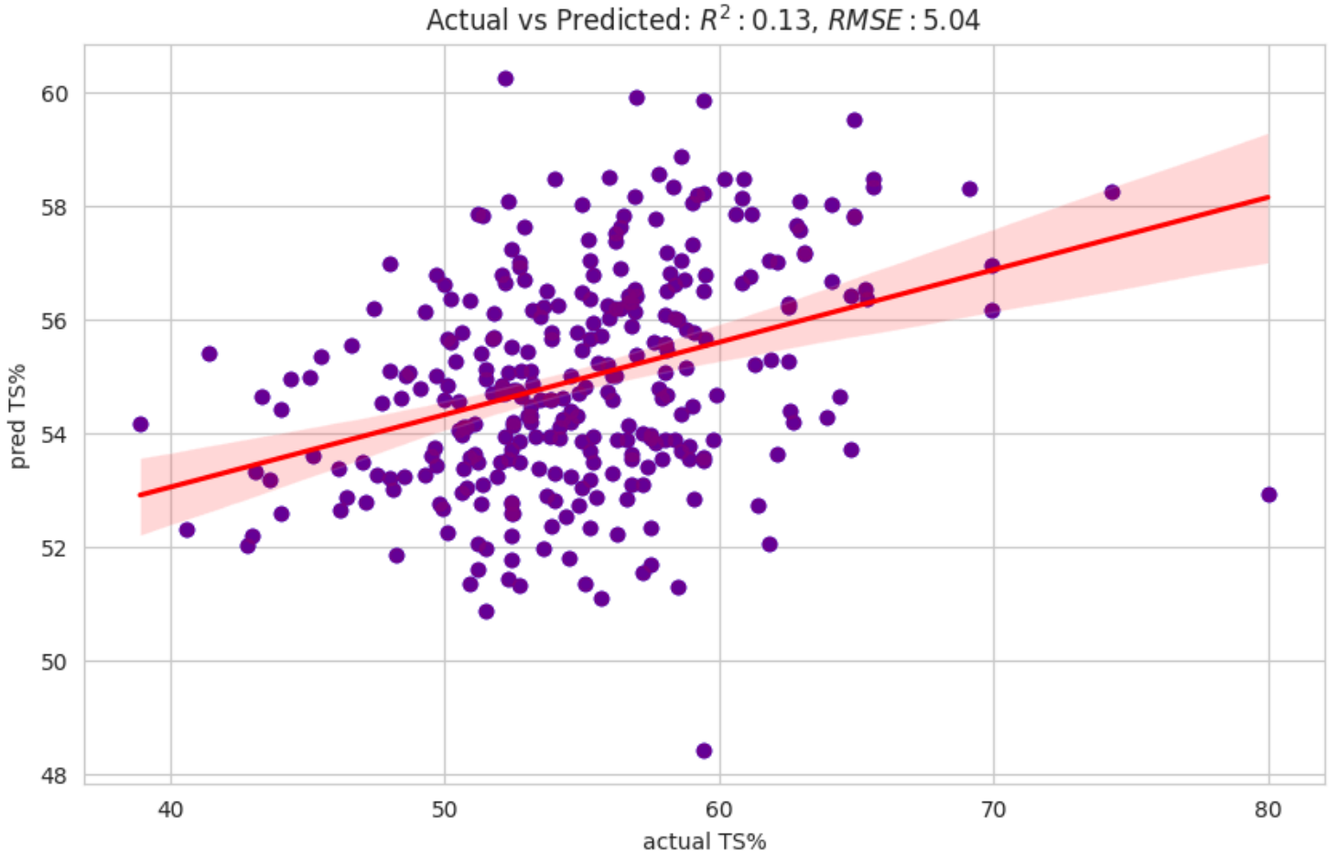
```
# Define the independent and dependent variables
X = advanced_stat_min[['AGE', 'HEIGHT', 'WEIGHT']]  # independent variables
y = advanced_stat_min['EFGP']  # dependent variable

# create split
X_train, X_test, y_train, y_test = train_test_split(X,y,
                                    random_state=104,
                                    test_size=0.2,
                                    shuffle=True)


# Create a linear regression model instance
model = LinearRegression()

# Fit the model
model.fit(X, y)

# Display the coefficients
print("Coefficients:", model.coef_)
print("Intercept:", model.intercept_)

# Use the model to make predictions
y_pred = model.predict(X)
```

```
Coefficients: [ 0.12964694  0.25082111 -0.00517487]
Intercept: 2.682527213502837
```

```
# Calculate MSE
mse = mean_squared_error(y, y_pred)
print("Mean Squared Error (MSE):", mse)

# Calculate RMSE
rmse = np.sqrt(mse)
print("Root Mean Squared Error (RMSE):", rmse)


# Calculate R-squared (R^2)
r2 = r2_score(y, y_pred)
print("R-squared (R^2):", r2)
```

```
Mean Squared Error (MSE): 25.45104216415517
Root Mean Squared Error (RMSE): 5.044902592137451
R-squared (R^2): 0.12753895595521492
```

```
#goodness of fit of predicted vs actual
plt.figure(figsize=(10, 6))
plt.scatter(y, y_pred, color='blue')
sns.regplot(x=y, y=y_pred, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Actual vs Predicted: $R^2:{r2:.2f}$, $RMSE: {rmse:.2f}$')
plt.xlabel('actual EFG%')
plt.ylabel('pred EFG%')
plt.show()
```



Block Percentage

Should be a height correlated event as typically centers lead a teams blk% Just a final cute analysis to show off.

```
# now lets take players who actually get real minutes a game
# and player defense: Want BLK and BLK_PCT
q = """SELECT DISTINCT p.AGE, p.HEIGHT, p.WEIGHT, d.BLK, d.BLK_PCT, d.ID, d.PLAYER, d.MIN FROM defense d
       JOIN players p on d.id = p.id WHERE MIN > 15 & BLK > 0.5"""
def_stat_min = pd.read_sql(sa.text(q), connection)
```

```
def_stat_min
```

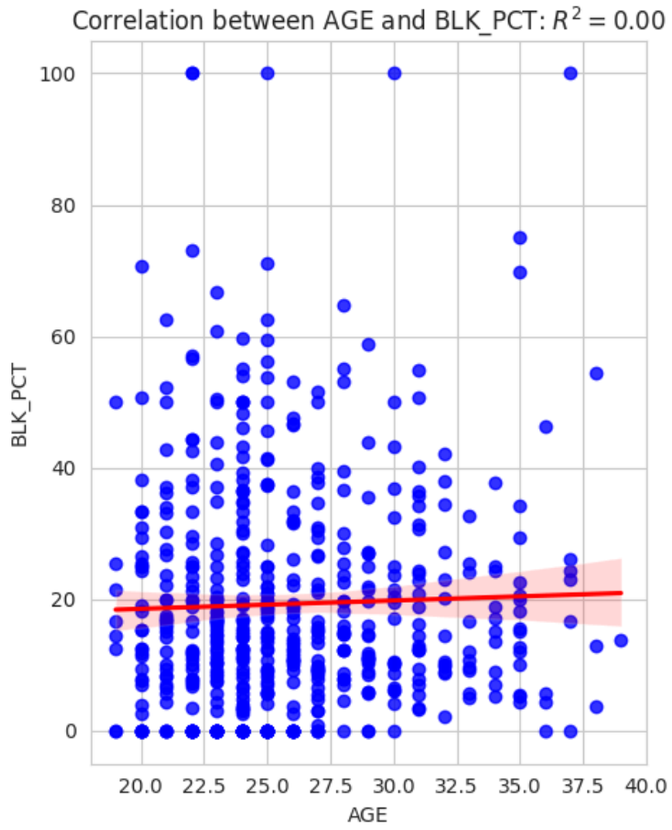
	AGE	HEIGHT	WEIGHT	BLK	BLK_PCT	ID	PLAYER	MIN
0	23	198.12	179	0.1	11.1	1	A.J. Lawson	7.9
1	24	193.04	190	0.0	6.5	2	AJ Green	9.6
2	20	198.12	220	0.1	7.7	3	AJ Griffin	7.4
3	28	203.20	235	0.6	19.7	4	Aaron Gordon	31.4
4	27	182.88	185	0.1	5.4	5	Aaron Holiday	16.5
...	...	...	...	...	...	...	...	...
549	26	210.82	250	0.7	31.9	550	Zach Collins	23.3
550	29	195.58	200	0.3	10.3	551	Zach LaVine	34.9
551	23	205.74	240	0.7	37.1	552	Zeke Nnaji	9.8
552	22	205.74	185	0.2	7.2	553	Ziaire Williams	20.3
553	23	198.12	284	0.6	18.0	554	Zion Williamson	30.7

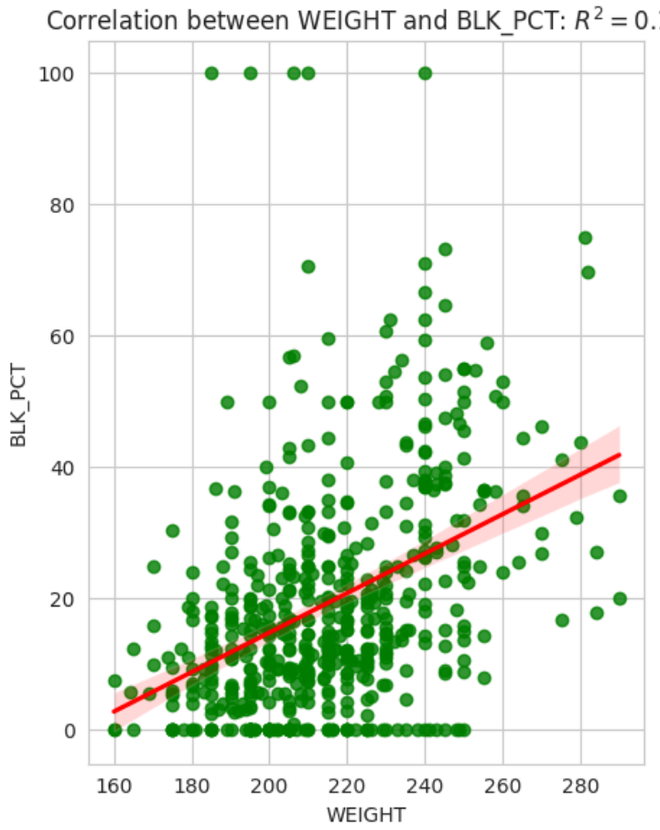
554 rows × 8 columns

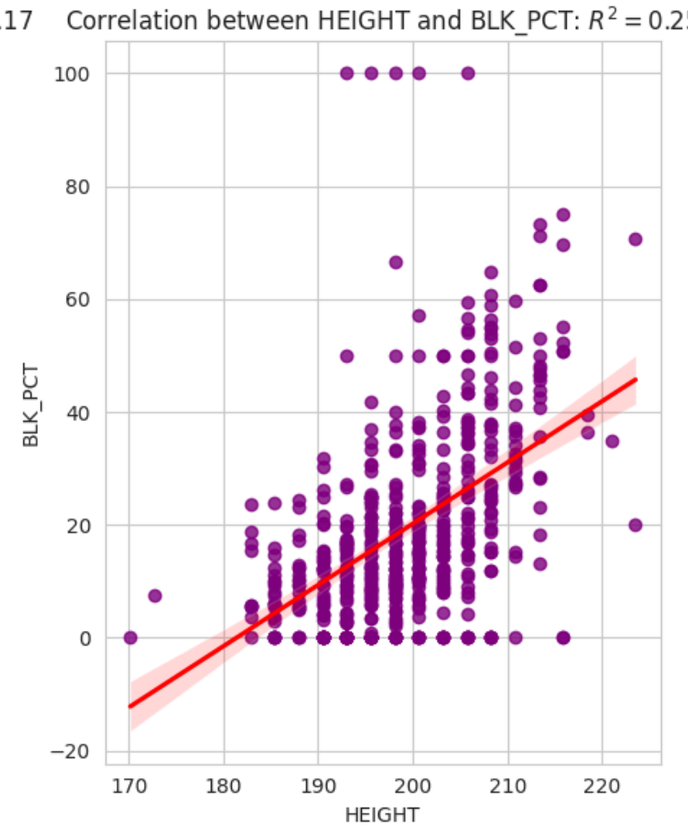
Next steps: Generate code with def_stat_min | View recommended plots

```
# get R2 for all three:
ager =calculate_r_squared(def_stat_min, 'AGE', 'BLK_PCT')
wr =calculate_r_squared(def_stat_min, 'WEIGHT', 'BLK_PCT')
hr =calculate_r_squared(def_stat_min, 'HEIGHT', 'BLK_PCT')
sns.set_style("whitegrid")

# Create a figure with subplots
plt.figure(figsize=(14, 6))

# Plot for Column1 vs Column3
plt.subplot(1, 3, 1)  # 1 row, 2 columns, 1st subplot
sns.regplot(x='AGE', y='BLK_PCT', data=def_stat_min, scatter_kws={"color": "blue"}, line_kws={"color": "red"})
plt.title(f'Correlation between AGE and BLK PCT: $R^2={ager:.2f}$')
```

```
# Plot for Column2 vs Column3
plt.subplot(1, 3, 2)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='WEIGHT', y='BLK_PCT', data=def_stat_min, scatter_kws={"color": "green"}, line_kws={"color": "red"})
plt.title(f'Correlation between WEIGHT and BLK_PCT: $R^2={wr:.2f}$')

# Plot for Column2 vs Column3
plt.subplot(1, 3, 3)  # 1 row, 2 columns, 2nd subplot
sns.regplot(x='HEIGHT', y='BLK_PCT', data=def_stat_min, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Correlation between HEIGHT and BLK_PCT: $R^2={hr:.2f}$')

# Display the plots
plt.tight_layout()
plt.show()
```







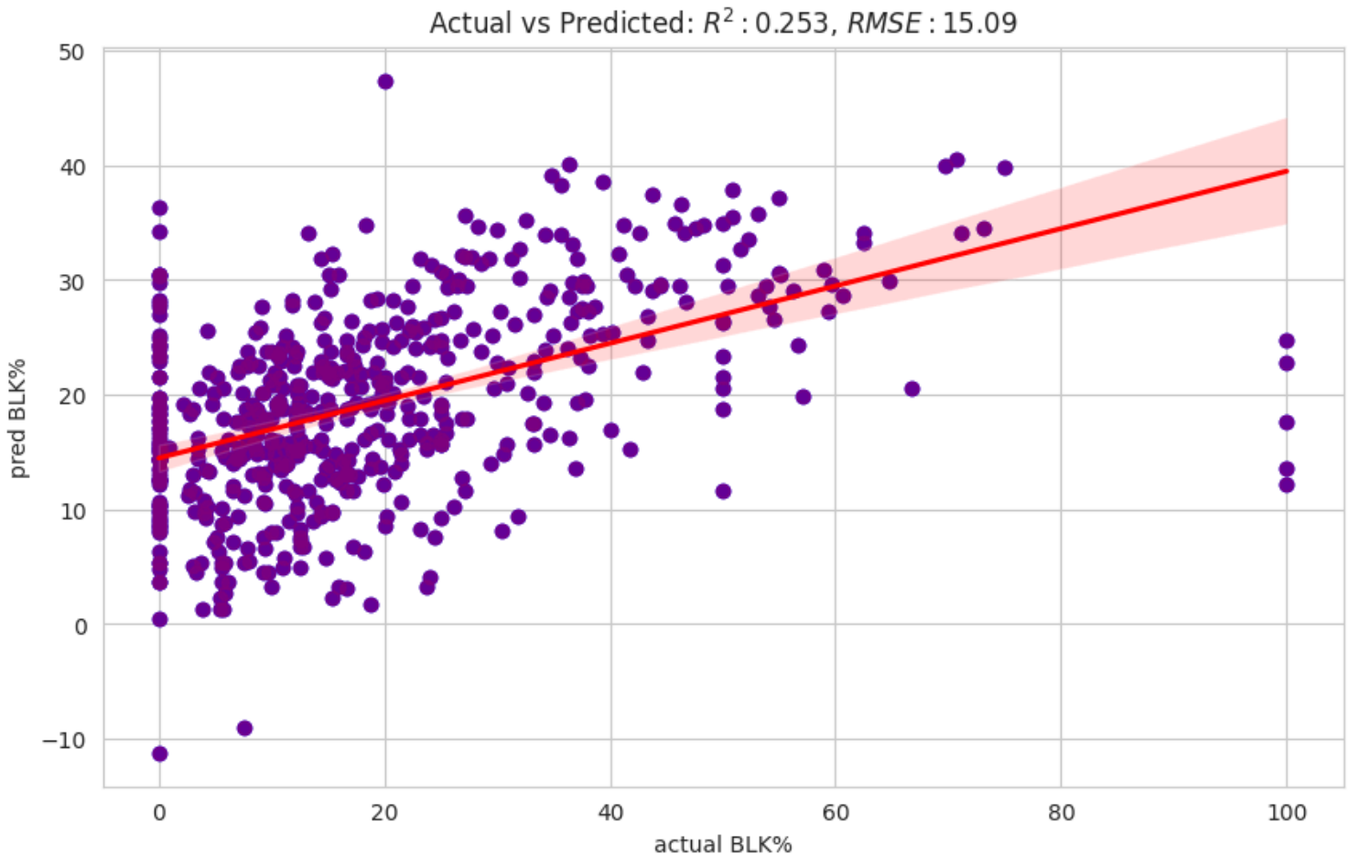
```
# Define the independent and dependent variables
X = def_stat_min[['AGE', 'HEIGHT', 'WEIGHT']]  # independent variables
y = def_stat_min['BLK_PCT']  # dependent variable

# create split
X_train, X_test, y_train, y_test = train_test_split(X,y,
                                    random_state=104,
                                    test_size=0.2,
                                    shuffle=True)


# Create a linear regression model instance
model = LinearRegression()

# Fit the model
model.fit(X, y)

# Display the coefficients
print("Coefficients:", model.coef_)
print("Intercept:", model.intercept_)

# Use the model to make predictions
y_pred = model.predict(X)
```

```
    Coefficients: [0.04974184 0.9213872  0.0779815 ]
    Intercept: -182.26740634865885
```

```
# Calculate MSE
mse = mean_squared_error(y, y_pred)
print("Mean Squared Error (MSE):", mse)

# Calculate RMSE
rmse = np.sqrt(mse)
print("Root Mean Squared Error (RMSE):", rmse)


# Calculate R-squared (R^2)
r2 = r2_score(y, y_pred)
print("R-squared (R^2):", r2)
```

```
    Mean Squared Error (MSE): 227.6862597249119
    Root Mean Squared Error (RMSE): 15.089276315480205
    R-squared (R^2): 0.25331904342247635
```

```
#goodness of fit of predicted vs actual
plt.figure(figsize=(10, 6))
plt.scatter(y, y_pred, color='blue')
sns.regplot(x=y, y=y_pred, scatter_kws={"color": "purple"}, line_kws={"color": "red"})
plt.title(f'Actual vs Predicted: $R^2:{r2:.3f}$, $RMSE: {rmse:.2f}$')
plt.xlabel('actual BLK%')
plt.ylabel('pred BLK%')
plt.show()
```




```
from sklearn.linear_model import Lasso
# L1 version
# Create a linear regression model instance
lasso = Lasso(alpha=1.0)  # You can adjust alpha to see different results

# Fit the model
```