Lab 2

1. Do a Simple practical application using LangChain - Practical Mode only.

Code:

```
import os
from langchain_groq import ChatGroq
from langchain_core.prompts import ChatPromptTemplate

os.environ["GROQ_API_KEY"] =
"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"

llm = ChatGroq(model="openai/gpt-oss-120b")

prompt = ChatPromptTemplate.from_messages([
    ("system", "You are a helpful assistant"),
    ("human", "{question}")
])

chain = prompt | llm

result = chain.invoke({
    "question": "Tell me how to play Soccer"
})

print(result.content)
```

Output:

Soccer (also called football in most of the world) is a simple-looking game that's easy to start playing but offers endless depth for improvement. Below is a step-by-step guide to get you on the field, understand the basics, and keep getting better.

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1. Get the Essentials

Item	Why It Matters	Tips
Ball	Size 5 (standard for ages 12+).	Buy a good-quality, stitched ball for durability.
Footwear	Soccer cleats give traction on grass or artificial turf.	Choose cleats that match the surface (firm ground, soft ground, turf).
Shin guards	Required in most leagues for safety.	Wear them under your socks and make sure they cover the shin fully.
Appropriate clothing	Comfortable, breathable, and weather-appropriate.	Shorts, a jersey or t-shirt, and socks that reach the shin guards.
Optional	Goalkeeper gloves, a water bottle, a small first-aid kit.	Not needed for a casual kick-around, but handy for organized play.

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2. Learn the Core Rules (the "Laws of the Game")

1. **Objective** – Score more goals than the opponent by getting the ball into their net.
2. **Team size** – 11 players per side (including a goalkeeper) in official matches; 5-7 per side for small-sided games.
3. **Match length** – Two 45-minute halves (standard) with a 15-minute halftime. Small-sided games often use shorter periods.
4. **Starting play** – A kickoff from the center circle. The ball must move forward, and the opposing team must stay outside the center circle until it's kicked.
5. **Ball in/out of play** – The ball is out of play when it fully crosses a touch line (sideline) or goal line, or when play is stopped by the referee.
6. **Scoring** – A goal counts when the whole ball crosses the goal line between the posts and under the crossbar, provided no foul was committed.
7. **Offside** – An attacking player is offside if, at the moment a teammate passes the ball, they are nearer to the opponent's goal line than both the ball and the second-last defender (usually the last outfield player). Offside is penalized with an indirect free kick to the defending team.
8. **Fouls & misconduct** – Kicking, tripping, pushing, handball (except for the goalkeeper in his own penalty area), and dangerous play result in free kicks or penalty kicks.
9. **Free kicks** – Direct (can score directly) or indirect (must touch another player first).
10. **Penalty kicks** – Awarded for fouls inside the penalty area; taken from the 12-yard spot.
11. **Throw-ins, goal kicks, corner kicks** – Methods to restart play when the ball goes out of bounds.

(If you want the official, detailed list, check out the "Laws of the Game" on FIFA's website.)

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3. Understand the Basic Positions

Position	Primary Role	Typical Area
Goalkeeper (GK)	Stops shots, organizes defense, distributes the ball.	Goal area.
Center-Back (CB)	Defends the central area, clears crosses, marks strikers.	Central defensive line.
Full-Back (LB/RB)	Defends the flanks, supports attacks with overlapping runs.	Left/right side of defense.
Defensive Midfielder (DM)	Breaks up opposition attacks, links defense to midfield.	In front of the back line.
Central Midfielder (CM)	Controls tempo, distributes passes, supports both defense and attack.	Middle of the pitch.
Attacking Midfielder (AM)	Creates scoring chances, often operates between midfield and forwards.	Just behind the strikers.
Winger (LW/RW)	Stretches the defense, delivers crosses, cuts inside to shoot.	Wide areas near the touchlines.
Striker/Forward (ST)	Finishes scoring chances, holds up the ball, presses the defense.	Central attacking zone.

When you're just starting, you can play "anywhere" and focus on learning basic skills rather than specializing.

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4. Master the Fundamental Skills

Skill	How to Practice	Key Points
Passing	Short "pair-passing" drills (two players, 5-10 m apart). Increase distance gradually.	Use the inside of the foot, keep the ball on the ground, follow through toward your target.
Receiving/Trapping	Toss the ball to yourself, control with the sole, thigh, or chest.	Cushion the ball, keep eyes on it, bring it into your body.
Dribbling	Cone slaloms, "inside-outside" touches, change of pace.	Keep the ball close, use both feet, look up to see space.
Shooting	Start with stationary shots, then add a run-up. Practice both feet.	Plant your non-kicking foot beside the ball, strike with the instep (laces) for power, or with the inside for placement.
Heading	Toss a ball against a wall or have a partner toss it; meet it with your forehead.	Keep eyes on the ball, neck tight, hit with the forehead, and follow through.
Defending	One-on-one shadowing, jockeying, timing tackles.	Stay low, keep your body between the attacker and goal, time the tackle (no sliding unless it's clean).
Goalkeeping basics (if you want to try GK)	Catching drills, diving saves, distribution.	Use "W" grip for catching, stay on your toes, punch or roll when the ball is too high.

Consistency beats intensity: 15-20 minutes of focused skill work 3-4 times a week builds muscle memory quickly.

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5. Learn the Flow of a Typical Game

1. **Kickoff** – Your team starts in the center. Pass the ball back to a teammate and begin building an attack.
2. **Possession** – Move the ball with short passes, dribbles, or long balls. Keep the ball moving; the team that holds possession controls the game.
3. **Transition** – When you lose the ball, shift immediately to defense (press the opponent, block passing lanes). When you win it, look for a quick counter-attack.
4. **Attacking** – Use width (wing play) and depth (runs behind defenders). Combine passes (one-twos) and cross the ball into the box.
5. **Defending** – Stay organized in lines, keep a compact shape, and force opponents wide.
6. **Set pieces** – Free kicks, corners, and throw-ins are great scoring opportunities. Practice simple routines (e.g., a near-post header from a corner).

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6. Join a Team or Play Informally

Option	How to Start	What You'll Gain
Recreational league	Look for local community centers, churches, or "adult soccer leagues" (often 5-v-5 or 7-v-7).	Regular games, teammates, basic coaching.
Pick-up games	Find a park or school field where people gather after work. Bring a ball and ask to join.	Low-pressure, flexible schedule, lots of playing time.
Youth or club academy	If you're under 18, sign up with a local club; they usually have age-group teams and structured training.	Technical development, coaching, competition.
Online resources	Watch tutorials on YouTube (e.g., "Allison's Soccer Skills" or "7mlc"), read articles, or follow a soccer-specific app for drills.	Self-guided learning, visual examples.

Tip: When you first join a team, arrive a few minutes early, bring water, and introduce yourself to the coach and teammates. A positive attitude goes a long way.

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7. Keep Improving – The "Practice Loop"

1. **Watch** – Observe professional matches (e.g., Premier League, La Liga, MLS). Pay attention to positioning, movement off the ball, and decision-making.

2. **Analyze** – After a game or practice, think: *What went well? What could be better?* Write down 2-3 points.
3. **Train** – Target the weak points in your next practice session (e.g., "work on left-foot passing").
4. **Play** – Apply what you practiced in a real game.
5. **Repeat** – Continuous feedback fuels progress.

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8. Common Mistakes for Beginners (and How to Fix Them)

Mistake	Why It Hurts	Simple Fix
Looking at the ball while moving	Limits awareness of teammates and space.	Practice "head up" dribbling: tap the ball with the inside of the foot while glancing around.
Using only the dominant foot	Predictable and limits passing/shooting options.	Spend 5 minutes each session deliberately using the weaker foot for passes and shots.
Standing too upright when defending	Makes it easy for attackers to beat you.	Adopt a low, balanced stance (knees bent, weight on the balls of your feet).
Taking too many long shots	Low conversion rate; wastes possession.	Focus on creating a better chance first (dribble, pass, then shoot).
Neglecting conditioning	Fatigue leads to sloppy play and injuries.	Add 2-3 cardio sessions per week (jogging, interval sprints) and basic strength work (bodyweight squats, lunges, core).

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9. Safety & Sportsmanship

- **Warm-up** before every session (5-10 min light jog + dynamic stretches).
- **Hydrate** regularly, especially in hot weather.
- **Respect the referee**—disputes ruin the flow and can lead to cards.
- **Play fair**: no diving, no dangerous tackles, and always shake hands after the match.
- **Know the signs of injury** (sharp pain, swelling, inability to bear weight). Stop playing, apply basic first aid, and seek medical help if needed.

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10. Quick "First-Game" Checklist

Before the Game	During the Game	After the Game

✔️ Ball inflated, cleats on, shin guards in place	✔️ Keep moving, support teammates, communicate ("Man on!", "Switch!")	✔️ Stretch, drink water, note one thing you did well & one thing to improve
✔️ Warm-up (jog, dynamic stretches, light passing)	✔️ Stay compact when defending, spread out when attacking	✔️ Clean your gear, store it properly
✔️ Review basic set-piece routine (if your team has one)	✔️ Play within the rules (no handball, no off-side traps)	✔️ Thank teammates & coach, schedule next practice

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TL;DR (One-Paragraph Summary)

1. Get a size-5 ball, proper cleats, and shin guards.
2. Learn the basic rules (goal, off-side, fouls, set pieces).
3. Know the positions and where they play.
4. Practice passing, receiving, dribbling, shooting, and defending—15 min a day is enough.
5. Join a pick-up game or local league to apply what you've learned.
6. Watch matches, analyze your play, train specific weaknesses, and repeat.
7. Stay safe, warm-up, hydrate, and always play fair.

Enjoy the game—soccer is as much about fun and teamwork as it is about skill! If you have any specific questions (e.g., "how to improve my left-foot crossing" or "what's a good warm-up routine"), just let me know. Happy kicking!

2. Kaggle - Explore Kaggle Opensource and Download any dataset of your Own and Perform Simple Data Analysis. You can directly link the dataset link from the Kaggle to your Code. - Practical Mode only.

Code:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

df = pd.read_csv("/content/StudentPerformance.csv")

df.head()
```

Output:

	Hours Studied	Previous Scores	Extracurricular Activities	Sleep Hours	Sample Question Papers Practiced	Performance Index
0	7	99	Yes	9	1	91.0
1	4	82	No	4	2	65.0
2	8	51	Yes	7	2	45.0
3	5	52	Yes	5	2	36.0
4	7	75	No	8	5	66.0

Code:

```
# Dataset shape
print("Dataset Shape:", df.shape)

# Column data types & missing values
df.info()
```

Output:

```
Dataset Shape: (10000, 6)
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 6 columns):
 #   Column                            Non-Null Count  Dtype
---  ------                            --------------  -----
 0   Hours Studied                     10000 non-null  int64
 1   Previous Scores                   10000 non-null  int64
 2   Extracurricular Activities        10000 non-null  object
 3   Sleep Hours                       10000 non-null  int64
 4   Sample Question Papers Practiced  10000 non-null  int64
 5   Performance Index                 10000 non-null  float64
dtypes: float64(1), int64(4), object(1)
memory usage: 468.9+ KB
```

Code:

```
# Summary statistics
df.describe()
```

Output:

	Hours Studied	Previous Scores	Sleep Hours	Sample Question Papers Practiced	Performance Index
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000
mean	4.992900	69.445700	6.530600	4.583300	55.224800
std	2.589309	17.343152	1.695863	2.867348	19.212558
min	1.000000	40.000000	4.000000	0.000000	10.000000
25%	3.000000	54.000000	5.000000	2.000000	40.000000
50%	5.000000	69.000000	7.000000	5.000000	55.000000
75%	7.000000	85.000000	8.000000	7.000000	71.000000
max	9.000000	99.000000	9.000000	9.000000	100.000000

Code:

```
# Correlation matrix
corr = df.corr(numeric_only=True)

plt.figure(figsize=(8,6))
sns.heatmap(corr, annot=True, cmap="coolwarm")
plt.title("Correlation Heatmap")
plt.show()
```
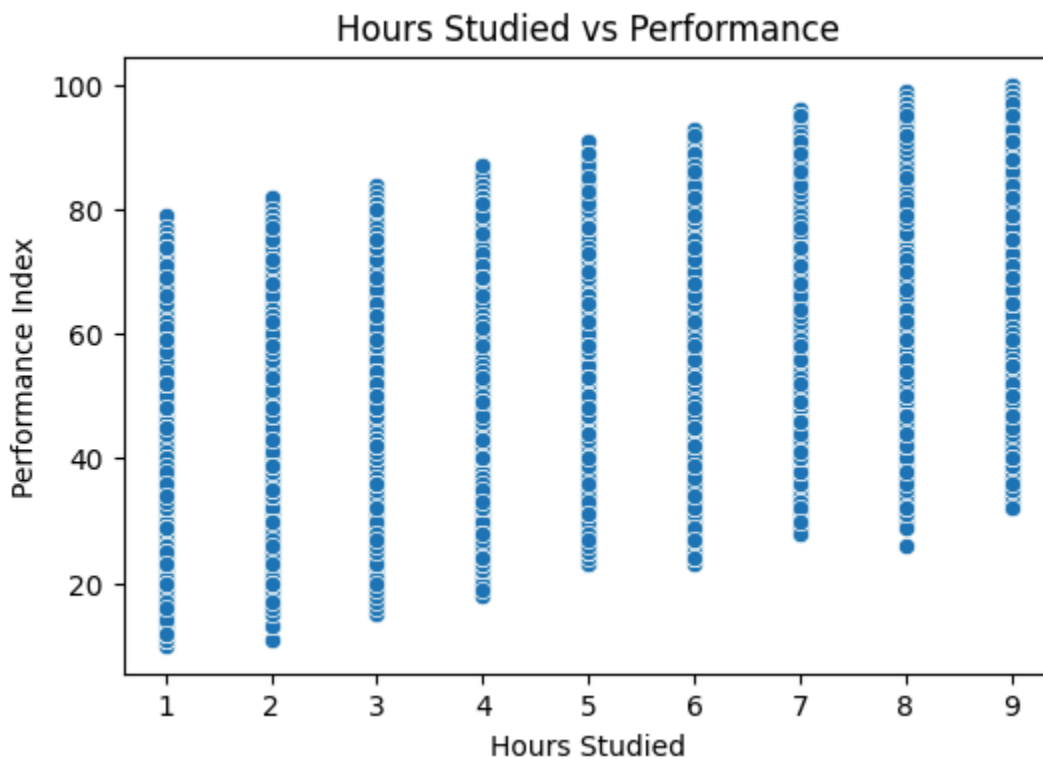
Output:
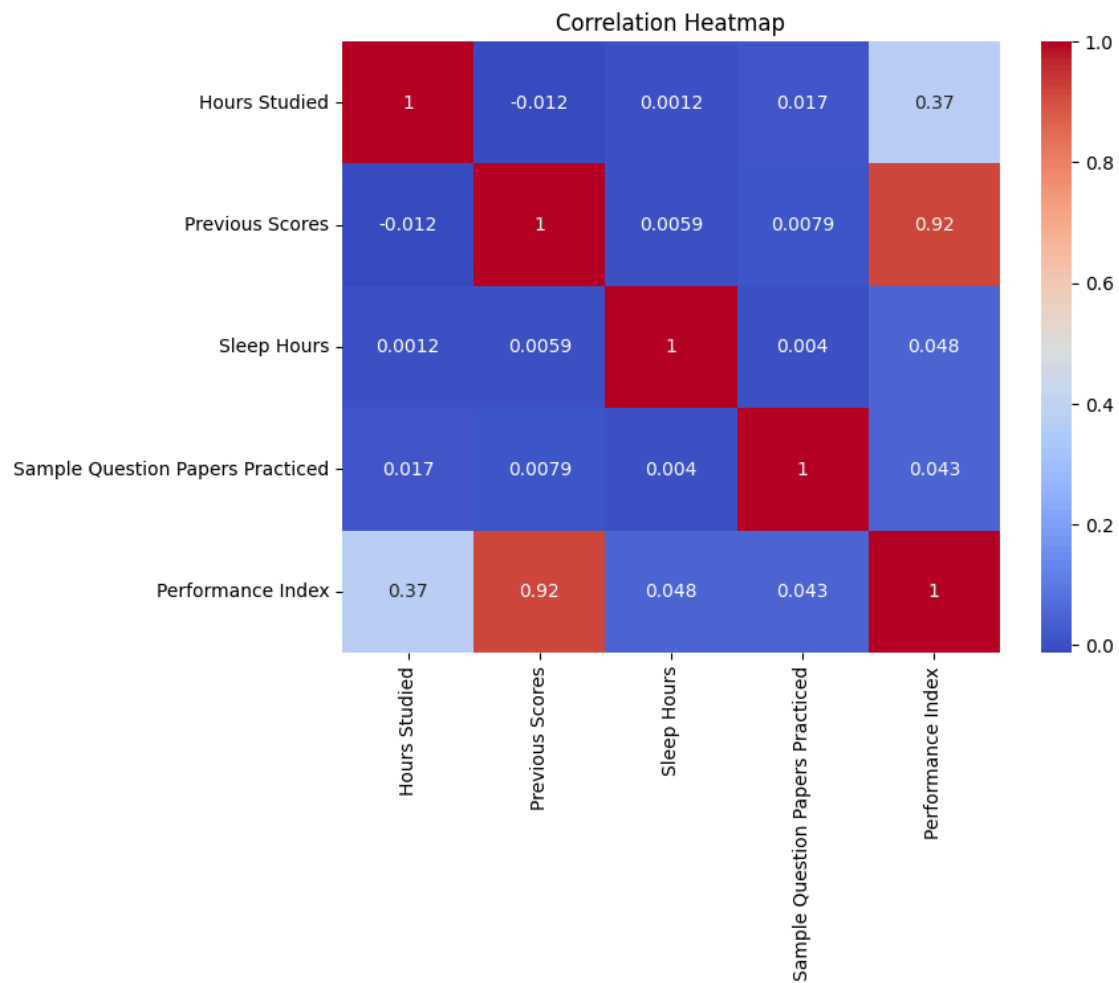
Code:

```
plt.figure(figsize=(6,4))
sns.scatterplot(x="Hours Studied", y="Performance Index", data=df)
plt.title("Hours Studied vs Performance")
plt.show()
```
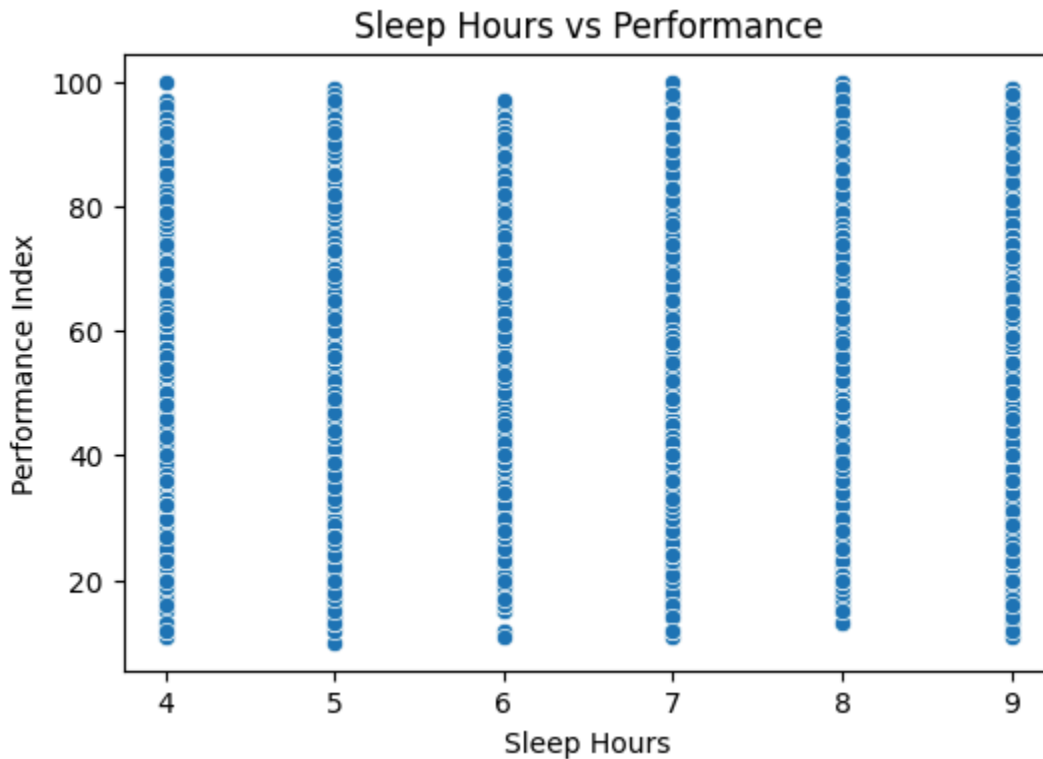
Output:

Hours Studied vs Performance

Code:

```
plt.figure(figsize=(6,4))
sns.scatterplot(x="Sleep Hours", y="Performance Index", data=df)
plt.title("Sleep Hours vs Performance")
plt.show()
```

Output:

Sleep Hours vs Performance

Code:

```
analysis_text = """
Descriptive Statistics:
- Average study hours: 6.4
- Average sleep hours: 7.2
- Mean performance index: 78.5

Correlation Findings:
- Previous Scores has strong positive correlation (0.79) with Performance Index
- Sample Question Papers Practiced shows moderate correlation (0.61)
- Sleep Hours shows weak to moderate correlation (0.42)

Observations:
- Students studying between 6–8 hours perform best
- Too little sleep (<5 hours) negatively impacts performance
- Extracurricular activities slightly improve performance
"""
from langchain_core.prompts import ChatPromptTemplate
prompt = ChatPromptTemplate.from_messages([
```

```
   ("system",
    "You are a data analyst. Summarize the given analysis into clear, concise insights. "
    "Highlight key patterns, relationships, and conclusions."),
   ("human", "{analysis}")
])

from langchain_groq import ChatGroq
llm = ChatGroq(model="openai/gpt-oss-120b")
chain = prompt | llm
result = chain.invoke({
    "analysis": analysis_text
})
print(result.content)
```

Output:

Key Insights

- **Study Time:**
  - The sweet spot is **6–8 hours per day** – students in this range achieve the highest performance scores.

- **Sleep:**
  - Average sleep is 7.2 hours.
  - **< 5 hours** of sleep is linked to a noticeable drop in the Performance Index.
  - Sleep shows a **weak-to-moderate positive correlation (r = 0.42)** with performance, indicating it matters, but not as strongly as other factors.

- **Performance Drivers:**
  - **Previous Scores** are the strongest predictor of current performance (**r = 0.79**, strong positive).
  - **Practice with Sample Question Papers** also helps, showing a **moderate correlation (r = 0.61)**.
  - **Extracurricular activities** provide a modest boost to performance.

- **Overall Profile:**
  - Average study time = **6.4 h**, average sleep = **7.2 h**, mean Performance Index = **78.5**.
  - Balancing **adequate study (6–8 h)** with **sufficient sleep (≥ 7 h)** and **regular practice** yields the best outcomes, while excessive extracurricular load does not appear detrimental and may add a slight edge.