# EXPERIMENT 12 - Building a Rule-Based Expert System using Shell Scripting

## Aim

The objective of this lab exercise is to build a simple rule-based expert system using shell scripting. The expert system will provide recommendations based on a set of predefined rules.

This script acts as a **rule-based expert assistant** for the **F1 Qatar Grand Prix** at the Lusail International Circuit.
Users enter keywords (e.g., "race", "tyres", "qualifying", "transport", etc.) and the script generates relevant information or tips.

## Modified Rules

**I created a total of 12 rules in the expert system, each of which contains 2–3 conditional checks to accurately detect and recommend solutions for different symptoms.**

## Script

```
#!/bin/bash

display_header() {
    echo "-----------------------------------------"
    echo "      F1 QATAR GRAND PRIX HELPER"
    echo "-----------------------------------------"
    echo
}

get_keywords() {
    echo "Enter keywords about what you want to know (separated by space):"
    echo "Examples: practice qualifying race tyres tickets transport weather spectating safety"
    read -r user_input
    # normalize to lowercase
    keywords=$(echo "$user_input" | tr 'A-Z' 'a-z')
}

evaluate_rules() {
    local matched=false
    echo
    echo " RECOMMENDATIONS / INFO "
    echo "------------------------"
    echo

    # RULE: General Qatar/Losail info
    if [[ "$keywords" == *"qatar"* ]] || [[ "$keywords" == *"losail"* ]]; then
        echo "- Qatar / Losail Circuit:"
        echo "  • The Losail International Circuit is fast and modern; expect high-speed corners and strong
brakes zones."
        echo "  • It's known for dramatic races and good overtaking opportunities at designated straights
and braking points."
        matched=true
        echo
    fi

    # RULE: Practice
    if [[ "$keywords" == *"practice"* ]] || [[ "$keywords" == *"fp1"* ]] || [[ "$keywords" == *"fp2"* ]]; then
        echo "- Practice sessions:"
        echo "  • Practice is used by teams to fine-tune setup and tyre strategy — it's less about lap times
and more about data-gathering."
        echo "  • Watch for long-run pace and tyre wear indicators."
        matched=true
        echo
    fi

    # RULE: Qualifying
    if [[ "$keywords" == *"qualifying"* ]] || [[ "$keywords" == *"q1"* ]] || [[ "$keywords" == *"q2"* ]] || [[
"$keywords" == *"q3"* ]]; then
        echo "- Qualifying tips:"
```

```
        echo "  • Qualifying position matters for clean air at Losail — good grid position helps avoid first-lap chaos."
        echo "  • Track evolution and temperature strongly affect lap times."
        matched=true
        echo
    fi

    # RULE: Race strategy / tyres
    if [[ "$keywords" == *"race"* ]] || [[ "$keywords" == *"strategy"* ]] || [[ "$keywords" == *"tyre"* ]] || [[ "$keywords" == *"tyres"* ]]; then
        echo "- Race strategy & tyres:"
        echo "  • Tyre wear is critical at Lusail due to long high-speed corners."
        echo "  • Undercut/overcut strategies can be decisive."
        echo "  • Sand on the track can reduce grip early in the weekend."
        matched=true
        echo
    fi

    # RULE: Weather / night race
    if [[ "$keywords" == *"weather"* ]] || [[ "$keywords" == *"wind"* ]] || [[ "$keywords" == *"sand"* ]] || [[ "$keywords" == *"night"* ]] || [[ "$keywords" == *"heat"* ]]; then
        echo "- Weather & track conditions:"
        echo "  • Qatar events can be affected by wind and sand — reducing grip and stability."
        echo "  • Evening temperatures increase grip as the night progresses."
        matched=true
        echo
    fi

    # RULE: Spectating / tickets / fan info
    if [[ "$keywords" == *"tickets"* ]] || [[ "$keywords" == *"spectator"* ]] || [[ "$keywords" == *"grandstand"* ]]; then
        echo "- Spectator & ticket tips:"
        echo "  • Buy tickets from verified sellers; check seat location and fan zone access."
        echo "  • Ear protection is recommended."
        matched=true
        echo
    fi

    # RULE: Transport / parking
    if [[ "$keywords" == *"transport"* ]] || [[ "$keywords" == *"parking"* ]] || [[ "$keywords" == *"shuttle"* ]]; then
        echo "- Transport & logistics:"
        echo "  • Allow extra travel time due to event traffic and security checks."
        echo "  • Check for shuttle buses or park-and-ride services."
        matched=true
        echo
    fi

    # RULE: Safety / incidents
    if [[ "$keywords" == *"safety"* ]] || [[ "$keywords" == *"crash"* ]] || [[ "$keywords" == *"incident"* ]]; then
```

```
        echo "- Safety & incidents:"
        echo "  • Follow marshals and FIA instructions."
        echo "  • Avoid entering restricted or unsafe areas."
        matched=true
        echo
    fi

    # RULE: Pitlane
    if [[ "$keywords" == *"pit"* ]] || [[ "$keywords" == *"pitstop"* ]]; then
        echo "- Pitlane & pitstop info:"
        echo "  • Pitstops are extremely fast and time-critical."
        echo "  • Access is restricted to authorized staff."
        matched=true
        echo
    fi

    # RULE: Track layout / overtaking
    if [[ "$keywords" == *"overtake"* ]] || [[ "$keywords" == *"layout"* ]] || [[ "$keywords" == *"corners"*
]]; then
        echo "- Overtaking & circuit layout:"
        echo "  • Main passing zones are on the start-finish straight and heavy braking corners."
        echo "  • DRS zones affect overtaking opportunities."
        matched=true
        echo
    fi

    # RULE: Broadcasting / how to watch
    if [[ "$keywords" == *"watch"* ]] || [[ "$keywords" == *"stream"* ]] || [[ "$keywords" == *"tv"* ]]; then
        echo "- Watching & broadcast:"
        echo "  • Check local broadcasters for session timing."
        echo "  • Verify time zone differences."
        matched=true
        echo
    fi

    # RULE: Entertainment / concerts / afterparty
    if [[ "$keywords" == *"afterparty"* ]] || [[ "$keywords" == *"concert"* ]] || [[ "$keywords" ==
*"entertainment"* ]]; then
        echo "- Events & entertainment:"
        echo "  • Many Grands Prix include concerts and fan-zone events."
        matched=true
        echo
    fi

    # Fallback
    if [[ "$matched" == false ]]; then
        echo "- No specific match found."
        echo "  • Check official event schedule."
        echo "  • Bring sun/ear protection; stay hydrated."
        echo "  • Follow event social media for last-minute updates."
        echo
```

```
    fi

    echo "IMPORTANT:"
    echo " • This script provides general guidance only."
    echo " • Always follow FIA, Formula 1, and official event sources for accurate information."
    echo
}

# Main
display_header
get_keywords
evaluate_rules
exit 0
```

# Output

```
nongshim@ubuntu:~/Downloads$ vim expert_system.sh
nongshim@ubuntu:~/Downloads$ chmod 744 expert_system.sh
nongshim@ubuntu:~/Downloads$ ./expert_system.sh
----------------------------------------
      F1 QATAR GRAND PRIX HELPER
----------------------------------------

Enter keywords about what you want to know (separated by space):
Examples: practice qualifying race tyres tickets transport weather spectating safety


 RECOMMENDATIONS / INFO
-----------------------

- No specific match for your keywords.
  General tips for attending/understanding a Grand Prix:
   • Check the official event schedule for practice / qualifying / race times.
   • Review transport, entry, and bag policy before you go.
   • Bring sun/ear protection and comfortable clothing; stay hydrated if daytime, or layered clothing for cooler night sessions.
   • Follow official social channels and the event website for last-minute updates.

IMPORTANT:
 • The information provided is general guidance only.
 • For official rules, ticketing, safety, and live updates always refer to the FIA, Formula 1, and the event's official websites or authorized sellers.

nongshim@ubuntu:~/Downloads$ ./expert_system.sh
----------------------------------------
      F1 QATAR GRAND PRIX HELPER
----------------------------------------

Enter keywords about what you want to know (separated by space):
Examples: practice qualifying race tyres tickets transport weather spectating safety


 RECOMMENDATIONS / INFO
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- No specific match for your keywords.
  General tips for attending/understanding a Grand Prix:
   • Check the official event schedule for practice / qualifying / race times.
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```

# Summary Report

# Challenges Faced

- Designing clear and non-overlapping rules for the F1 Qatar Grand Prix was challenging because many topics
  (like race strategy, tyres, qualifying, and weather) are often related and overlap naturally.
- Handling free-text user input was difficult due to possible spelling mistakes and variations in keywords
  (e.g., “tyres”, “tire”, “tires”, “tyre wear”).
  The script was written using lowercase conversion to avoid such mismatches.
- Multiple rules can be matched when the user enters more than one keyword, such as “race tyres weather”.
  This allows the script to output combined F1-related insights for a more detailed response.
- The **if-conditional structure** works effectively for F1 content because each keyword directly represents
  a specific type of racing information (strategy, overtaking, transport, etc.).
- Ensuring proper fallback behaviour was important so that the script still provides meaningful guidance
  even if the user enters unrelated or empty input.
- The general F1 helper system is simple, interactive, and easy to modify.
  Additional race-specific rules can be added without changing the core logic.
- A new design/theme style was added

# Observations Made

- The expert system correctly accepts user input and processes it successfully.
- Multiple rules can be matched when the user enters more than one F1 Rules.
- The if conditional statements work effectively for rule evaluation.
- The system displays correct recommendations and Pit rules to be executed.
- The general recommendation is shown only when no specific rule matches.
- The script is simple, interactive, and easy to use.

# Improvements That Can Be Made

- A menu-driven input system can be added to avoid spelling errors.
- Input validation can be introduced to handle invalid or empty input.
-

A loop can be added to allow the user to run the expert system multiple times without restarting the script.

- Rules can be stored in an external file for easier modification and scalability.
- Logging user input and outputs to a file can be added for analysis and debugging.
- More health-related rules can be added to make the expert system more comprehensive.

# CONCLUSION

- The rule-based expert system was successfully implemented using shell scripting.
- The system explains the Losail circuit and warmth to be effect the tyres .
- Conditional statements were effectively used to implement multiple F1 rules.
- The inclusion of example circuit made the system more informative and practical.
- The fallback general recommendation ensures that the system always provides guidance.