

Experiment [12]: [Expert system using shell scripting]

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AIM:

- [To learn Basics of Shell programming]
- [Building a Rule-Based Expert System using Shell scripting]

Requirement:

- [Any linux distro, any kind of text editor (vs code, vim, notepad, nano,etc)]

Theory:

Process Automation and Job Scheduling

- cron - Time-based job scheduler for repetitive tasks
- Edit user crontab with crontab -e

```
Syntax: minute hour day month dayofweek command  
Example: 0 9 * * * /home/user/backup.sh executes daily at 9 AM
```

at - One-time job scheduling

- Schedule commands to run once at specific time

```
Example: echo "backup.sh" | at 2:00 AM tomorrow
```

System Administration Scripts Automation scripts for routine system management:

- Backups - Regular data backup and archiving
- User Management - Automated user creation and permission setup
- Log Monitoring - Real-time log analysis and alert generation
- System Health Checks - Resource monitoring and maintenance

Services and Daemons System service management using systemctl:

- systemctl start service - Start a service.
- systemctl stop service - Stop a service.
- systemctl status service - Check service status.
- systemctl enable service - Enable auto-start at boot.
- systemctl disable service - Disable auto-start.

procedure & observations

Lab:

1.

Task statement:

- [Create a shell script named “expert_system.sh”]
- [implement a set of rules using conditional statements (if-elif-else) within the script. Each rule should check for specific conditions and provide a corresponding recommendation]

command(s):

```
#!/bin/bash
echo "Welcome to the Medical Expert System"
echo "Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):"
read symptoms

if [[ "$symptoms" == *"fever"* ]]; then
    echo "Recommendation: Take fever reducer medication and rest."
fi
```

```
if [[ "$symptoms" == *"sore_throat"* ]]; then
    echo "Recommendation: Gargle with warm saltwater and stay hydrated."
fi
if [[ "$symptoms" == *"cough"* ]]; then
    echo "Recommendation: Drink warm fluids and take cough syrup."
fi
if [[ "$symptoms" == *"headache"* ]]; then
    echo "Recommendation: Rest in a quiet room and consider pain relief medication."
fi
if [[ "$symptoms" == *"cold"* ]]; then
    echo "Recommendation: Get plenty of rest and use decongestants if needed."
fi
if [[ "$symptoms" == *"stomach_pain"* ]]; then
    echo "Recommendation: Avoid solid foods initially and drink clear fluids."
fi

if [[ "$symptoms" != *"fever"* && "$symptoms" != *"sore_throat"* && "$symptoms" != *"cough"* && "$symptoms" != *"headache"* && "$symptoms" != *"cold"* && "$symptoms" != *"stomach_pain"* ]]; then
    echo "General Recommendation: Consult a doctor for accurate diagnosis."
fi
```

output:

```
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ vim exp12.1.sh
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.1.sh
Welcome to the Medical Expert System
Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):
headache
Recommendation: Rest in a quiet room and consider pain relief medication.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.1.sh
Welcome to the Medical Expert System
Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):
fever
Recommendation: Take fever reducer medication and rest.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.1.sh
Welcome to the Medical Expert System
Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):
sore_throat
Recommendation: Gargle with warm saltwater and stay hydrated.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.1.sh
Welcome to the Medical Expert System
Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):
cough
Recommendation: Drink warm fluids and take cough syrup.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.1.sh
Welcome to the Medical Expert System
Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):
cold
Recommendation: Get plenty of rest and use decongestants if needed.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.1.sh
Welcome to the Medical Expert System
Enter your symptoms (fever, sore_throat, cough, headache, cold, stomach_pain):
stomach_pain
Recommendation: Avoid solid foods initially and drink clear fluids.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ |
```

2. Example Rules:

Task statement:

- [If the user is experiencing fever, recommend taking a fever reducer medication]
- [If the user has a sore_throat, recommend gargling with warm saltwater]
- [If the user has a cough and congestion, recommend drinking warm fluids and taking cough syrup]
- [If user has a headache recommend Rest in a dark, quiet room]
- [If user has a cold recommend Get a plenty of rest and sleep]
- [If user has a stomach_pain recommend Avoid solid foods for few hours]
- [If user has a fatigue recommend Maintain balanced diet with iron-rich foods]
- [If user has a nausea recommend Drink ginger tea or peppermint tea]

command(s):

```
#!/bin/bash
echo "Welcome to the Enhanced Medical Expert System"
echo "Enter your symptoms separated by commas (fever, sore_throat, cough, headache, cold, stomach_pain, fatigue, nausea):"
read symptoms

symptoms_lower=$(echo "$symptoms" | tr '[:upper:]' '[:lower:]')

echo ""
echo "Medical Recommendations:"
echo "====="

recommendation_count=0

if [[ "$symptoms_lower" == *"fever"* ]]; then
    echo " Take fever reducer medication (paracetamol/ibuprofen)"
    echo " - Monitor temperature every 4 hours"
    echo " - Stay hydrated with water and electrolytes"
    ((recommendation_count++))
fi
```

```
if [[ "$symptoms_lower" == *"sore_throat"* ]]; then
    echo " Gargle with warm saltwater 3 times daily"
    echo " - Use throat lozenges for temporary relief"
    echo " - Avoid cold drinks and smoking"
    ((recommendation_count++))
fi

if [[ "$symptoms_lower" == *"cough"* ]]; then
    echo " Drink warm fluids like tea with honey"
    echo " - Use cough syrup as directed"
    echo " - Use a humidifier in your room"
    ((recommendation_count++))
fi

if [[ "$symptoms_lower" == *"headache"* ]]; then
    echo " Rest in a dark, quiet room"
    echo " - Apply cold compress to forehead"
    echo " - Consider pain relief medication if severe"
    ((recommendation_count++))
fi

if [[ "$symptoms_lower" == *"cold"* ]]; then
    echo " Get plenty of rest and sleep"
    echo " - Use saline nasal spray for congestion"
    echo " - Take vitamin C supplements"
    ((recommendation_count++))
fi

if [[ "$symptoms_lower" == *"stomach_pain"* ]]; then
    echo " Avoid solid foods for few hours"
    echo " - Drink clear fluids (water, broth)"
    echo " - Apply warm compress to abdomen"
    ((recommendation_count++))
fi

if [[ "$symptoms_lower" == *"fatigue"* ]]; then
    echo " Ensure 7-8 hours of quality sleep"
    echo " - Maintain balanced diet with iron-rich foods"
    echo " - Practice light exercise like walking"
```

```
((recommendation_count++))
fi

if [[ "$symptoms_lower" == *"nausea"* ]]; then
    echo " Drink ginger tea or peppermint tea"
    echo " - Eat small, frequent meals"
    echo " - Avoid strong smells and fatty foods"
    ((recommendation_count++))
fi

echo =====
if [ $recommendation_count -eq 0 ]; then
    echo "No specific symptoms recognized."
    echo "General Advice: Consult a healthcare professional for proper diagnosis."
else
    echo "Total recommendations provided: $recommendation_count"
    echo "Note: If symptoms persist for more than 3 days, consult a doctor."
fi
```

output:

```
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ vim exp12.2.sh
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.2.sh
Welcome to the Enhanced Medical Expert System
Enter your symptoms separated by commas (fever, sore_throat, cough, headache, cold, stomach_pain, fatigue, nausea):
fever

Medical Recommendations:
=====
Take fever reducer medication (paracetamol/ibuprofen)
- Monitor temperature every 4 hours
- Stay hydrated with water and electrolytes
=====

Total recommendations provided: 1
Note: If symptoms persist for more than 3 days, consult a doctor.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ ./exp12.2.sh
Welcome to the Enhanced Medical Expert System
Enter your symptoms separated by commas (fever, sore_throat, cough, headache, cold, stomach_pain, fatigue, nausea):
sore_throat , cold

Medical Recommendations:
=====
Gargle with warm saltwater 3 times daily
- Use throat lozenges for temporary relief
- Avoid cold drinks and smoking
Get plenty of rest and sleep
- Use saline nasal spray for congestion
- Take vitamin C supplements
=====

Total recommendations provided: 2
Note: If symptoms persist for more than 3 days, consult a doctor.
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ |
```

3.

Task Statement:

- [prompt the user to input their symptoms]
- [If none of the rules match the user's symptoms, provide a general recommendations]
- [Test the expert system by running the script and providing different sets of symptoms to observe the recommendations]

command(s):

```
#!/bin/bash
echo "Welcome to the Advanced Medical Expert System"
echo "Enter your symptoms separated by commas:"
read symptoms

symptoms_lower=$(echo "$symptoms" | tr '[:upper:]' '[:lower:]' | tr ',' ' ')
declare -A recommendations
declare -a matched_symptoms

recommendations["fever"]="Take fever reducer medication|Monitor temperature every 4 hours|Stay hydrated"
recommendations["sore_throat"]="Gargle with warm saltwater|Use throat lozenges|Avoid cold drinks"
recommendations["cough"]="Drink warm fluids with honey|Use cough syrup|Use humidifier"
recommendations["headache"]="Rest in dark room|Apply cold compress|Consider pain relief"
recommendations["cold"]="Get plenty of rest|Use saline nasal spray|Take vitamin C"
recommendations["stomach_pain"]="Avoid solid foods|Drink clear fluids|Apply warm compress"
recommendations["fatigue"]="Ensure 7-8 hours sleep|Eat iron-rich foods|Light exercise"
recommendations["nausea"]="Drink ginger tea|Eat small frequent meals|Avoid strong smells"

echo ""
echo "==== MEDICAL ADVICE REPORT ==="
echo "Input Symptoms: $symptoms"
echo ""

for symptom in "${!recommendations[@]}"; do
    if [[ "$symptoms_lower" == *"$symptom"* ]]; then
```

```
        matched_symptoms+=("$symptom")
    fi
done

if [ ${#matched_symptoms[@]} -gt 0 ]; then
    echo "RECOMMENDATIONS:"
    echo "-----"
    for symptom in "${matched_symptoms[@]}"; do
        echo "● For $symptom:"
        IFS='|' read -ra advice <<< "${recommendations[$symptom]}"
        for item in "${advice[@]}"; do
            echo "  - $item"
        done
        echo ""
    done
else
    echo "No specific symptoms recognized."
    echo "General Advice: Consult a healthcare professional."
fi

echo "GENERAL PRECAUTIONS:"
echo "-----"
echo " Wash hands frequently"
echo " Maintain social distance if infectious"
echo " Get adequate rest and nutrition"
echo " Seek emergency care for severe symptoms like:"
echo "   - Difficulty breathing"
echo "   - Chest pain"
echo "   - High fever (over 103°F)"
echo "   - Severe dehydration"
```

output:

```
vaishnavii29@DESKTOP-BSKS ~ + ×
Windows PowerShell: vaishnavii29@DESKTOP-
BSKS7E4: /mnt/c/Users/DELL/Desktop/New folder/linux t/c/Users/DELL/Desktop/New folder/linux$ ./exp12.3.sh
ctrl+alt+1
Expert System
Enter your symptoms separated by commas:
cough , cold , sore_throat , fever

==== MEDICAL ADVICE REPORT ====
Input Symptoms: cough , cold , sore_throat , fever

RECOMMENDATIONS:
-----


- For sore_throat:
  - Gargle with warm saltwater
  - Use throat lozenges
  - Avoid cold drinks
- For cold:
  - Get plenty of rest
  - Use saline nasal spray
  - Take vitamin C
- For cough:
  - Drink warm fluids with honey
  - Use cough syrup
  - Use humidifier
- For fever:
  - Take fever reducer medication
  - Monitor temperature every 4 hours
  - Stay hydrated



GENERAL PRECAUTIONS:
-----
Wash hands frequently
Maintain social distance if infectious
Get adequate rest and nutrition
Seek emergency care for severe symptoms like:
```

- Difficulty breathing
- Chest pain
- High fever (over 103°F)
- Severe dehydration

```
vaishnavii29@DESKTOP-BSKS7E4:/mnt/c/Users/DELL/Desktop/New folder/linux$ |
```

4.

Task Statement:

- [modify the rules match the user's symptoms, provide different sets of symptoms to observe the recommendation]
- [Document the logic and rules implemented in the script, along with any modifications or additions made]

Explanation:

Documentation Report:

- System Overview: The rule-based medical expert system provides preliminary health recommendations based on user-reported symptoms using pattern matching and conditional logic.
- Rules and Logic:
 1. Input Processing: Case-insensitive symptom matching using string comparison.
 2. Rule Structure: IF-THEN rules for each symptom-recommendation pair.
 3. Multiple Recommendations: Support for concurrent multiple symptom analysis.
 4. Default Handling: General medical advice for unrecognized symptoms

Symptom-Recommendation Mapping:

- Fever - Medication, temperature monitoring, hydration
- Sore Throat - Saltwater gargle, lozenges, avoid irritants
- Cough - Warm fluids, cough syrup, humidifier
- Headache - Rest, cold compress, pain relief
- Cold - Rest, nasal spray, vitamin C

- Stomach Pain - Dietary adjustment, fluids, warm compress
- Fatigue - Sleep optimization, nutrition, light exercise
- Nausea - Ginger tea, meal management, odor avoidance

Summary:

1. Enhanced Symptom Coverage: Added 3 new symptoms (headache, cold, stomach pain) plus fatigue and nausea.
2. Multiple Recommendation Display: Implemented array-based system to handle concurrent symptoms.
3. Structured Output: Organized recommendations with bullet points and categories.
4. Cron Integration: Automated daily execution capability.
5. User Experience: Case-insensitive input, clear formatting, general precautions.
6. Error Handling: Default advice for unrecognized inputs.

Technical Implementation:

- Bash string manipulation for pattern matching.
- Associative arrays for symptom-recommendation storage.
- Cron scheduling for automation.
- Modular rule structure for easy expansion.

Challenges faced:

- Syntax error
- creating Extra information
- making a script normal - enhanced - Advanced version with more detailing.