

Theoretical Knowledge Assessment

Multiple Choice Questions

1. What does the root directory ("/") represent in Linux file systems?

Possible Answers: a) The primary user folder b) The top-level directory containing all system folders ✓ c) A temporary storage location d) A backup directory

2. Which command is used to change file permissions?

Possible Answers: a) change b) chmod ✓ c) permit d) access

3. What do the letters 'rwx' represent in file permissions?

Possible Answers: a) Read, Write, Execute ✓ b) Run, Web, Xpress c) Root, Window, Xfer d) Restore, Wipe, Xchange

Short Answer Questions

1. Explain the difference between absolute and relative file paths.

Hint: Consider how paths are referenced from different starting points

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2. Describe the three permission levels in Linux file systems.

Hint: Think about user, group, and others permissions

Practical Command Challenges

Directory Navigation Exercise

Use the following directory structure for your tasks:

```
/home/student/  
├── documents/  
│   ├── reports/  
│   └── personal/  
├── projects/  
│   ├── web/  
│   └── programming/  
└── downloads/
```

1. Write the command to move from /home/student to the reports directory

2. List all contents of the projects directory

3. Create a new directory called 'backup' in the documents folder

4. Copy all files from downloads to the backup directory

Permission Management Scenarios

Scenario 1: Team Project Permissions

You're managing a team project with specific access requirements:

- Project lead: Full access
- Team members: Read/write access
- External consultants: Read-only access

Complete the following tasks:

1. Demonstrate chmod commands to set these permissions

2. Explain the numeric and symbolic permission representations

3. Discuss potential security risks in this scenario

Hint: Consider using chmod with numeric (755) and symbolic (+rwx) modes

Advanced File System Exploration

File System Hierarchy Challenge

Analyze and map the standard Linux file system hierarchy

```
/
├── bin/      (Essential user binaries)
├── boot/     (Boot loader files)
├── dev/      (Device files)
├── etc/      (System configuration)
├── home/     (User home directories)
├── lib/      (Essential shared libraries)
├── media/    (Removable media mount points)
├── opt/      (Optional application software)
├── proc/     (Virtual filesystem for processes)
├── root/     (Root user home directory)
├── sbin/     (System administration binaries)
├── tmp/      (Temporary files)
├── usr/      (User utilities and applications)
└── var/      (Variable data files)
```

1. Explain the purpose of three directories that are critical for system operations

2. Describe the difference between /bin and /sbin directories

3. Why is the /proc directory considered a virtual filesystem?

Pro Tip: Each directory serves a unique purpose in system organization and management!

Advanced File Management Techniques

Complex File Operations Workshop

Advanced file manipulation and searching techniques

```
Find Commands Examples:  
# Find files modified in last 7 days  
find /home -type f -mtime -7  
  
# Search for files larger than 100MB  
find / -type f -size +100M  
  
# Search with multiple conditions  
find /documents -name "*.pdf" -size +10M -mtime -30
```

1. Write a find command to locate all Python files modified in the last 14 days

2. Demonstrate how to combine find with other commands like grep or xargs

3. Explain the significance of different search parameters in find command

Advanced Tip: Combine find with other Unix tools for powerful file management!

Shell Scripting for File System Management

Automated File Management Script Challenge

```
#!/bin/bash
# Backup Script Template

BACKUP_DIR="/home/student/backups"
SOURCE_DIR="/home/student/documents"
DATE=$(date +"%Y%m%d")

# Create backup directory if not exists
mkdir -p $BACKUP_DIR

# Perform backup with timestamp
tar -czvf "$BACKUP_DIR/backup_$DATE.tar.gz" $SOURCE_DIR

# Optional: Remove backups older than 30 days
find $BACKUP_DIR -type f -mtime +30 -delete
```

1. Explain the purpose of each line in the provided backup script

2. Modify the script to include error handling and logging

3. Describe how you would schedule this script to run automatically

Pro Tip: Shell scripts can automate complex file system tasks efficiently!

Security and Permissions Deep Dive

Advanced Permission Scenarios

Permission Representation:

```
- Owner (User) : rwx  
- Group       : r-x  
- Others      : r--
```

Numeric Representation:

```
- r (read)    = 4  
- w (write)   = 2  
- x (execute) = 1
```

Examples:

```
- 755 = rwxr-xr-x  
- 644 = rw-r--r--  
- 600 = rw-----
```

1. Analyze the security implications of different permission settings

2. Design a permission strategy for a collaborative project

3. Explain how to use setuid, setgid, and sticky bit permissions

Critical Security Insight: Permissions are your first line of defense!

