

Set of 20 Logical Expressions (Short-Circuit Evaluation)

1. Checking Valid User Input:

username = "admin"

password = "1234"

is_valid = (username == "admin" and len(password) >= 4) or (len(username) < 5)

Question: Validate if the user input is correct based on username and password. Explain why the second condition may or may not evaluate.

2. Resource Allocation Check:

cpu_available = 60 # in percentage

memory_available = 2048 # in MB

allocate_resource = (cpu_available > 50 and memory_available > 2000) or memory_available == 4096

Question: Determine if the resource can be allocated based on CPU and memory availability.

3. Login Attempt Validation:

attempts = 3

locked = False

login_success = (attempts < 5 or not locked) and (attempts > 0)

Question: Validate if a login attempt can proceed. Explain which conditions would short-circuit.

4. Product Availability Check:

in_stock = 15

on_hold = 10

can_purchase = (in_stock > 5 or on_hold < 5) and in_stock > 0

Question: Determine if a product can be purchased based on stock and hold status.

5. File Operation Check:

file_exists = True

file_opened = False

can_read = (file_exists and not file_opened) or file_opened

Question: Check if the file can be read, given its current state.

6. Discount Eligibility:

is_member = True

purchase_amount = 120

eligible_for_discount = (is_member and purchase_amount >= 100) or purchase_amount > 150

Question: Determine if a customer is eligible for a discount based on membership and purchase amount.

7. System Update Condition:

is_online = True

battery_level = 50

can_update = (is_online and battery_level > 40) or battery_level > 80

Question: Check if the system can be updated based on connectivity and battery status.

8. Travel Eligibility Check:

has_passport = True

has_visa = False

travel_allowed = (has_passport and has_visa) or not has_visa

Question: Check if a person is allowed to travel based on passport and visa status.

9. Exam Eligibility:

attendance = 75

assignments_submitted = True

exam_eligible = (attendance >= 75 and assignments_submitted) or attendance > 80

Question: Determine if a student is eligible to take the exam based on attendance and assignment submission.

10. Security Check for File Access:

has_permission = False

is_owner = True

access_file = (has_permission or is_owner) and not has_permission

Question: Determine if a user can access a file based on permissions and ownership.

11. Online Purchase Approval:

payment_processed = True

stock_remaining = 3

purchase_successful = (payment_processed and stock_remaining > 0) or stock_remaining > 5

Question: Check if an online purchase can proceed based on payment and stock levels.

12. Application Form Validation:

is_complete = False

has_photo = True

form_accepted = (is_complete and has_photo) or not is_complete

Question: Validate if the form can be accepted, considering whether it's complete and has a photo attached.

13. Server Health Monitoring:

cpu_usage = 85

memory_usage = 90

server_healthy = (cpu_usage < 80 or memory_usage < 85) and (cpu_usage < 90 or memory_usage < 95)

Question: Check if the server is healthy based on CPU and memory usage.

14. Loan Approval Process:

credit_score = 700

income = 45000

loan_approved = (credit_score >= 650 and income > 40000) or income > 60000

Question: Determine if a loan can be approved based on credit score and income.

15. Insurance Eligibility:

age = 45

medical_checkup = False

eligible_for_insurance = (age < 50 or medical_checkup) and age > 30

Question: Check if a person is eligible for insurance based on age and medical checkup status.

16. System Maintenance Window:

is_weekend = True

low_traffic = False

schedule_maintenance = (is_weekend or low_traffic) and not low_traffic

Question: Determine if system maintenance can be scheduled based on traffic and day of the week.

17. Multi-Factor Authentication:

password_correct = True

otp_verified = False

mfa_successful = password_correct and (otp_verified or not otp_verified)

Question: Check if multi-factor authentication (MFA) succeeds based on password and OTP verification.

18. Job Promotion Eligibility:

experience_years = 5

has_recommendation = False

promotion_approved = (experience_years > 3 or has_recommendation) and not

has_recommendation

Question: Check if an employee is eligible for a promotion based on experience and recommendation.

19. Customer Support Chat Availability:

agents_available = True

queue_length = 5

can_join_chat = agents_available or (queue_length < 10 and not agents_available)

Question: Determine if a customer can join a support chat based on agent availability and queue length.

20. E-Commerce Cart Validation:

items_in_cart = 4

logged_in = False

checkout_possible = (items_in_cart > 0 and logged_in) or (not logged_in and items_in_cart > 2)

Question: Check if a customer can proceed to checkout based on cart items and login status.

Instructions for Students:

1. **Identify Logical Flow:** Analyze each expression and determine when short-circuiting will occur.
2. **Short-Circuit Evaluation:** Explain which parts of the expression are skipped due to short-circuiting (e.g., if False and X skips evaluating X).
3. **Step-by-Step Evaluation:** Break down each condition, ensuring you understand when and why an expression halts further evaluation.
4. **Apply Logic:** Reason through the logic of each scenario and evaluate whether the final result will be True or False.