Dayananda Sagar University

Department of Computer Science and Engineering

Critical Thinking– Icebreaker Activity

Water Jug Puzzle Worksheet

Name and USN:

Date of Activity: 13 September 2025

Instructions: Start with both jugs empty. In each step, write what you did under Action (e.g., 'Fill 5L', 'Pour 5L → 3L', 'Empty 3L') and record the amounts in each jug under 5L and 3L. Try to reach a state where the 5L jug shows exactly 4. Use as few steps as possible.

Hint: You can fill a jug from the tap, empty a jug to the drain, or pour from one jug to the other until either the source is empty or the destination is full.

Attempt 1

Step	Action	5L	3L
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

CRITICAL THINKING

Attempt 2

Step	Action	5L	3L
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Bonus: Why is it always possible to measure 4 liters using a 5L and 3L jug? Tip: Think about the greatest common divisor (gcd) of 5 and 3.

Attempt 2

Critical Thinking– Icebreaker Activity

The Two Rope Burning Puzzle Worksheet

Name and USN:

Date of Activity: 13 September 2025

Problem:
You have two ropes. Each rope burns for exactly 1 hour, but the ropes burn unevenly (meaning half the rope might take 10 minutes while the other half could take 50 minutes).
Task: How can you measure exactly 45 minutes?

Instructions:
Work in pairs or groups. Use logical reasoning to figure out how lighting the ropes at different ends can help you measure exactly 45 minutes. Fill in your steps below.

Step	Action / Observation
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Bonus Question:
Why is it important to notice that the ropes burn unevenly? What mistake might someone make if they assumed the ropes burned at a constant rate?

Critical Thinking– Icebreaker Activity

The Bridge and Torch Puzzle Worksheet

Name and USN:

Date of Activity: 13 September 2025

Problem:
Four people need to cross a bridge at night with one torch. The bridge can only hold 2 at a time. They all walk at different speeds: 1 minute, 2 minutes, 7 minutes, and 10 minutes. When 2 people cross together, they must move at the slower person's pace.

Question: How can they all cross in exactly 17 minutes?

Instructions:
Work in pairs or groups. Write down each step of who crosses the bridge, who returns with the torch, and the time taken. Your goal is to get all four people across in 17 minutes or less. Fill in your plan below:

Step	Who Crosses / Returns	Time Taken (min)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Bonus Question:
Why is it better to sometimes send the faster people back with the torch, instead of always the slower ones? What does this puzzle teach us about resource allocation in teams?

Critical Thinking – Icebreaker Activity
The Wolf, Goat, and Cabbage Puzzle Worksheet

Name and USN:

Date of Activity: 13 September 2025

Problem:
A farmer needs to take a wolf, a goat, and a cabbage across a river. The boat can only carry the farmer and one item at a time. If left alone, the wolf will eat the goat, and the goat will eat the cabbage.

Task: How can the farmer get all three safely across the river?

Instructions:
Work in pairs or groups. Write down each crossing step (who goes, who returns).

Step	Action
1	
2	
3	
4	
5	
6	
7	
8	
9	

Bonus Question: Why is it important to plan ahead instead of just making random moves?

Critical Thinking – Icebreaker Activity
The Light Bulb Switch Puzzle Worksheet

Name and USN:

Date of Activity: 13 September 2025

Problem:
You are outside a room with 3 switches, each connected to one of 3 light bulbs inside. You can only enter the room once. Task: How can you determine which switch controls which bulb?

Instructions:
Work in groups. Record your reasoning process below.

Step	Action / Observation
1	
2	
3	
4	
5	
6	
7	
8	

Bonus Question: How does this puzzle demonstrate the value of indirect evidence?

Critical Thinking – Icebreaker Activity
The Monty Hall Problem Worksheet

Name and USN:

Date of Activity: 13 September 2025

Problem:

You are on a game show with 3 doors: behind one is a car, behind two are goats. You choose Door A. The host opens Door B, which has a goat. The host then asks: 'Do you want to switch to Door C?' Task: Should you stay with your choice or switch? Justify your reasoning.

Instructions:
Work in pairs or groups. Discuss probabilities and logic. Record your reasoning.

Step	Reasoning / Notes
1	
2	
3	
4	
5	
6	
7	

Bonus Question: What does this puzzle teach us about intuition vs. mathematical reasoning?

River Crossing Puzzle: A farmer needs to cross a river with a wolf, a goat, and a cabbage. His boat can carry only him and one item. If left alone, the wolf eats the goat, and the goat eats the cabbage. How can he get them all across safely?

Bridge Crossing Problem: Four people need to cross a bridge at night. They have one torch. The bridge can only hold two people at a time. Each person walks at different speeds: 1, 2, 5,and 10 minutes. If two people cross, they move at the slower person's pace. How can they all cross in 17 minutes?

"What did you learn about problem-solving today?"

"How is critical thinking different from guessing?"

"Did teamwork help or slow you down?"

"How did teamwork help in solving them?"

"How can you apply this way of thinking to studies, work, or daily life?"

Teacher's Solution – Bridge and Torch Puzzle

Problem Recap:

Four people (1 min, 2 min, 7 min, 10 min) must cross a bridge at night with one torch. At most two can cross at a time, and pairs move at the slower person's pace. Goal: Get everyone across in exactly 17 minutes.

Optimal 17-Minute Plan (using 1 and 2 as torch shuttles):

Step	Action (→ = go, ← = return)	Time for Step	Cumulative Time
1	1 & 2 → (cross together)	2 min	2 min
2	1 ← (returns with torch)	1 min	3 min
3	7 & 10 → (cross together)	10 min	13 min
4	2 ← (returns with torch)	2 min	15 min
5	1 & 2 → (cross together)	2 min	17 min

Explanation of Optimality:
There are two common strategies:

• Strategy A (used above): Send the two fastest (1 & 2) first, bring 1 back; send the two slowest (7 & 10), bring 2 back; send the two fastest again. Total = 2 + 1 + 10 + 2 + 2 = 17.

• Strategy B: Send 1 with each of the slowest one by one (e.g., 1 & 10, 1 returns, 1 & 7, 1 returns…), which is slower.
Comparing totals shows 17 minutes is minimal for times (1,2,7,10).

Teacher's Solution – Two Rope Burning Puzzle

Problem Recap:
You have two ropes. Each rope burns for exactly 1 hour, but the ropes burn unevenly. Measure exactly 45 minutes.

Step-by-Step Solution:

Step	Action	Elapsed Time
1	Light Rope A at BOTH ends and Rope B at ONE end.	0 min
2	When Rope A burns out completely, 30 minutes have passed (double-ended burning halves the total time).	30 min
3	At the moment Rope A finishes, light the OTHER end of Rope B.	30 min
4	Rope B now has 30 minutes of burn time remaining at one end, but with both ends lit it will finish in half that time (15 minutes).	30–45 min
5	When Rope B burns out, the total elapsed time is 45 minutes.	45 min

Why this works:

Even though each rope burns unevenly along its length, burning a rope from BOTH ends guarantees it finishes in exactly half its total time. Thus, Rope A gives a precise 30 minutes. Using that moment to light Rope B's other end makes the remaining 30 minutes finish in 15 more minutes, totaling 45 minutes.

Teacher's Solution – Wolf, Goat, and Cabbage Puzzle

Step-by-Step Solution:
1. Farmer takes Goat across.
2. Farmer returns alone.
3. Farmer takes Wolf across.
4. Farmer brings Goat back.
5. Farmer takes Cabbage across.
6. Farmer returns alone.
7. Farmer takes Goat across.

✅ All items safely cross without being eaten.

Teacher's Solution – Light Bulb Switch Puzzle

Step-by-Step Solution:
1. Turn on Switch 1 and leave it for 5 minutes.
2. Turn off Switch 1, turn on Switch 2.
3. Enter the room:
   • Bulb ON = Switch 2
   • Bulb OFF but WARM = Switch 1
   • Bulb OFF and COLD = Switch 3

✅ Each bulb can be identified in one attempt.

Teacher's Solution – Monty Hall Problem

Explanation:
• If you STAY: chance of winning = 1/3 (only if car was behind your first choice).
• If you SWITCH: chance of winning = 2/3 (car is behind one of the other doors).

✅ Best strategy is always to SWITCH.

Lesson: Human intuition often fails against probability. Critical thinking helps overcome this bias.