

## Artificial Intelligence and Machine Learning

### Experiment 1

**Problem Statement:** In the missionaries and cannibals' problem, three missionaries and three cannibals must cross a river using a boat which can carry at most two people, under the constraint that, for both banks, if there are missionaries present on the bank, they cannot be outnumbered by cannibals (if they were, the cannibals would eat the missionaries). The boat cannot cross the river by itself with no people on board.

**Implementation:**

```
import time

def print_slow(text, delay=0.03):
    for char in text:
        print(char, end='', flush=True)
        time.sleep(delay)
    print()

def print_river(left_m, left_c, right_m, right_c, boat_position):
    river = f"{'M' * left_m}{'C' * left_c}{' ' * (6 - left_m - left_c)}"
    river += " | "
    if boat_position == 'left':
        river += "<==="
    else:
        river += "--->"
    river += " | "
    river += f"{' ' * (6 - right_m - right_c)}{'M' * right_m}{'C' *
right_c}"
    print_slow(river)

def get_valid_input(prompt, max_value):
    while True:
        try:
            value = int(input(prompt))
            if 0 <= value <= max_value:
                return value
            print(f>Please enter a number between 0 and {max_value}.")
        except ValueError:
            print("Invalid input. Please enter a number.")

def main():
```

```

print_slow("\n\t=== Missionaries & Cannibals Game ===\n")
print_slow("Goal: Move all missionaries and cannibals to the right side of
the river.")
    print_slow("Rules:")
    print_slow("1. The boat can carry at most two people")
    print_slow("2. If cannibals outnumber missionaries on either side, the
cannibals eat the missionaries")
    print_slow("3. The boat cannot cross the river empty\n")

    left_m, left_c = 3, 3
    right_m, right_c = 0, 0
    attempts = 0
    boat_position = 'left'

    while True:
        print_river(left_m, left_c, right_m, right_c, boat_position)

        if boat_position == 'left':
            print_slow("\nLeft to Right:")
            m = get_valid_input("Enter number of Missionaries to move: ",
left_m)
            c = get_valid_input("Enter number of Cannibals to move: ",
left_c)
        else:
            print_slow("\nRight to Left:")
            m = get_valid_input("Enter number of Missionaries to move: ",
right_m)
            c = get_valid_input("Enter number of Cannibals to move: ",
right_c)

        if m + c == 0 or m + c > 2:
            print_slow("Invalid move. The boat must carry 1 or 2 people.")
            continue

        if boat_position == 'left':
            left_m, left_c = left_m - m, left_c - c
            right_m, right_c = right_m + m, right_c + c
            boat_position = 'right'
        else:
            left_m, left_c = left_m + m, left_c + c
            right_m, right_c = right_m - m, right_c - c
            boat_position = 'left'

        attempts += 1

```

```

if (left_c > left_m > 0) or (right_c > right_m > 0):
    print_river(left_m, left_c, right_m, right_c, boat_position)
    print_slow("\nGame Over! Cannibals ate the missionaries.")
    break

if right_m == right_c == 3:
    print_river(left_m, left_c, right_m, right_c, boat_position)
    print_slow(f"\nCongratulations! You won in {attempts} moves.")
    break

if __name__ == "__main__":
    main()

```

Solving:

```

=== Missionaries & Cannibals Game ===

Goal: Move all missionaries and cannibals to the right side of the river.
Rules:
1. The boat can carry at most two people
2. If cannibals outnumber missionaries on either side, the cannibals eat the missionaries
3. The boat cannot cross the river empty

MMMCCC |<--|

Left to Right:
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 2
MMMC   |--->|      CC

Right to Left:
Enter number of Missionaries to move: 1
Please enter a number between 0 and 0.
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 1
MMMCC  |<--|      C

Left to Right:
Enter number of Missionaries to move: 1
Enter number of Cannibals to move: 1
MMC    |--->|      MCC

Game Over! Cannibals ate the missionaries.

```

## Attempt 2

```
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 2
MMM   |--->|   CCC

Right to Left:
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 1
MMMC  |<--|   CC

Left to Right:
Enter number of Missionaries to move: 2
Enter number of Cannibals to move: 0
MC     |--->|  MMCC

Right to Left:
Enter number of Missionaries to move: 1
Enter number of Cannibals to move: 1
MMCC  |<--|   MC

Left to Right:
Enter number of Missionaries to move: 2
Enter number of Cannibals to move: 0
CC     |--->|  MMMC

Right to Left:
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 1
CCC    |<--|   MMM

Left to Right:
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 2
C      |--->|  MMMCC

Right to Left:
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 1
CC     |<--|   MMMC

Left to Right:
Enter number of Missionaries to move: 0
Enter number of Cannibals to move: 2
      |--->|  MMMCCC

Congratulations! You won in 11 moves.
```

## What is PEAS?

1. Performance Measure: Performance measure is the unit to define the success of an agent. Performance varies with agents based on their different precepts.
2. Environment: Environment is the surrounding of an agent at every instant. It keeps changing with time if the agent is set in motion.
3. Actuator: An actuator is a part of the agent that delivers the output of action to the environment.
4. Sensor: Sensors are the receptive parts of an agent that takes in the input for the agent.

In the given scenario, the PEAS will be as follows:

1. Performance Measure
  - a. Successfully transporting all missionaries and cannibals across the river without any missionaries being outnumbered by cannibals on either side.
  - b. Minimize the number of crossings required to achieve the goal.
2. Environment
  - a. A river with a boat that can carry a maximum of two people at a time.
  - b. Two riverbanks, with missionaries and cannibals initially starting on one bank.
3. Actuators
  - a. The boat used to transport the missionaries and cannibals across the river.
  - b. Actions include moving the boat across the river with one or two passengers or moving the boat back to the original side.
4. Sensors
  - a. The agent's awareness of the number of missionaries and cannibals on each side of the river at any given time.
  - b. The agent's awareness of the boat's current location and its capacity.