**Experiment-No.3**

**Objective:** Write a program to implement missionary and cannibal algorithm.

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| **Scheduled Date:** | **Compiled Date:** | **Submitted Date:** |
| 11 Sep 2023 | 16 Sep 2023 | 18- Sep 2023 |

**Description of Missionary and Cannibal:**

The Missionaries and Cannibals problem is a classic puzzle where three missionaries and three cannibals must cross a river using a boat that holds two people. The challenge is to ensure that, on either side of the river, the cannibals never outnumber the missionaries, as this would lead to the missionaries being eaten. The boat requires at least one person to operate, and either one or two people can cross at a time. The objective is to safely transport all the missionaries and cannibals to the other side, making it a popular problem for exploring search algorithms and state-space exploration in AI.

**Algorithm for Missionary and Cannibal:**

**1. Initialize Variables:**

- Set M1 = 3 (missionaries on the left side).

- Set C1 = 3 (cannibals on the left side).

- Set M2 = 0 (missionaries on the right side).

- Set C2 = 0 (cannibals on the right side).

**2. Display Rules:**

- Show the user the available rules for moving missionaries and cannibals across the river:

- Rule 1: One cannibal moves to the right.

- Rule 2: One missionary moves to the right.

- Rule 3: Two cannibals move to the right.

- Rule 4: Two missionaries move to the right.

- Rule 5: One cannibal and one missionary move to the right.

- Rule 6: One cannibal moves to the left.

- Rule 7: One missionary moves to the left.

- Rule 8: Two cannibals move to the left.

- Rule 9: Two missionaries move to the left.

- Rule 10: One cannibal and one missionary move to the left.

**3. Begin Loop:**

**Condition:** Continue the loop until all 3 missionaries and all 3 cannibals are on the right side (M2 = 3 and C2 = 3).

**4. Take User Input:**

- Ask the user to select a rule (1 to 10).

**5. Update Missionary and Cannibal Counts Based on Rule:**

- If Rule 1: Move one cannibal from left to right:

- C1 = C1 - 1, C2 = C2 + 1.

- If Rule 2: Move one missionary from left to right:

- M1 = M1 - 1, M2 = M2 + 1.

- If Rule 3: Move two cannibals from left to right:

- C1 = C1 - 2, C2 = C2 + 2.

- If Rule 4: Move two missionaries from left to right:

- M1 = M1 - 2, M2 = M2 + 2.

- If Rule 5: Move one cannibal and one missionary from left to right:

- C1 = C1 - 1, C2 = C2 + 1, M1 = M1 - 1, M2 = M2 + 1.

- If Rule 6: Move one cannibal from right to left:

- C1 = C1 + 1, C2 = C2 - 1.

- If Rule 7: Move one missionary from right to left:

- M1 = M1 + 1, M2 = M2 - 1.

- If Rule 8: Move two cannibals from right to left:

- C1 = C1 + 2, C2 = C2 - 2.

- If Rule 9: Move two missionaries from right to left:

- M1 = M1 + 2, M2 = M2 - 2.

- If Rule 10: Move one cannibal and one missionary from right to left:

- C1 = C1 + 1, C2 = C2 - 1, M1 = M1 + 1, M2 = M2 - 1.

**6. Display Current Status:**

- Show how many missionaries and cannibals are on both sides (left: M1, C1; right: M2, C2).

**7. Check for Failed Condition:**

- If on the left side (M1 < C1 and M1 > 0) or on the right side (M2 < C2 and M2 > 0), print "Cannibals eat Missionaries" and exit from the loop.

**8. Repeat:**

- Continue the loop until all 3 missionaries and 3 cannibals are on the right side (M2 = 3, C2 = 3).

**9. End Game:**

- Once all missionaries and cannibals are on the right side (M2 = 3, C2 = 3), the game ends successfully.

**Python Code for missionaries and cannibals :**

M1 = 3

C1 = 3

M2 = 0

C2 = 0

print("Missionary Cannibal Problem")

print("Rules are ")

print("Rule 1 : One C moves to Left")

print("Rule 2 : One M moves to Left")

print("Rule 3 : Two C moves to Left")

print("Rule 4 : Two M moves to Left")

print("Rule 5 : One C and One M moves to Left")

print("Rule 6 : One C moves to Right")

print("Rule 7 : One M moves to Right")

print("Rule 8 : Two C moves to Right")

print("Rule 9 : Two M moves to Right")

print("Rule 10 : One C and One M moves to Right")

while M2 != 3 or C2 != 3:

r = int(input("Enter rule:- "))

if r == 1:

print("one C moves to right")

C1 -= 1

C2 += 1

elif r == 2:

print("one M moves to right")

M1 -= 1

M2 += 1

elif r == 3:

print("two C moves to right")

C1 -= 2

C2 += 2

elif r == 4:

print("two M moves to right")

M1 -= 2

M2 += 2

elif r == 5:

print("one C and one M moves to right")

C1 -= 1

C2 += 1

M1 -= 1

M2 += 1

elif r == 6:

print("one C moves to left")

C1 += 1

C2 -= 1

elif r == 7:

print("one M moves to left")

M1 += 1

M2 -= 1

elif r == 8:

print("two C moves to left")

C1 += 2

C2 -= 2

elif r == 9:

print("two M moves to left")

M1 += 2

M2 -= 2

elif r == 10:

print("one C and one M moves to left")

C1 += 1

C2 -= 1

M1 += 1

M2 -= 1

print("On Left side : " , (C1,M1))

print("on right side : " ,(C2,M2))

if (M1 < C1 and M1 > 0) or (M2 < C2 and M2 > 0):

print("Cannibals eat Missionaries")

break