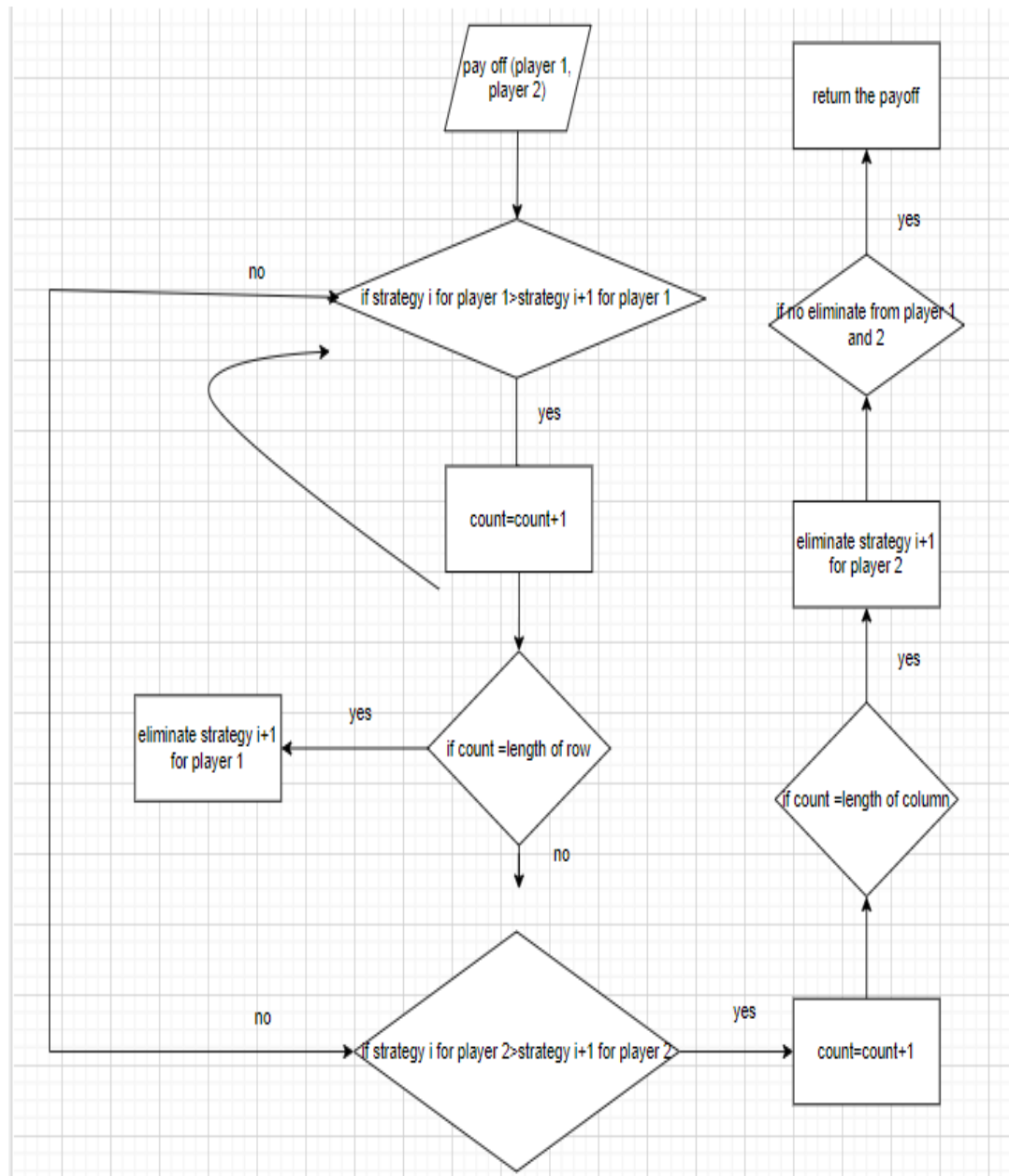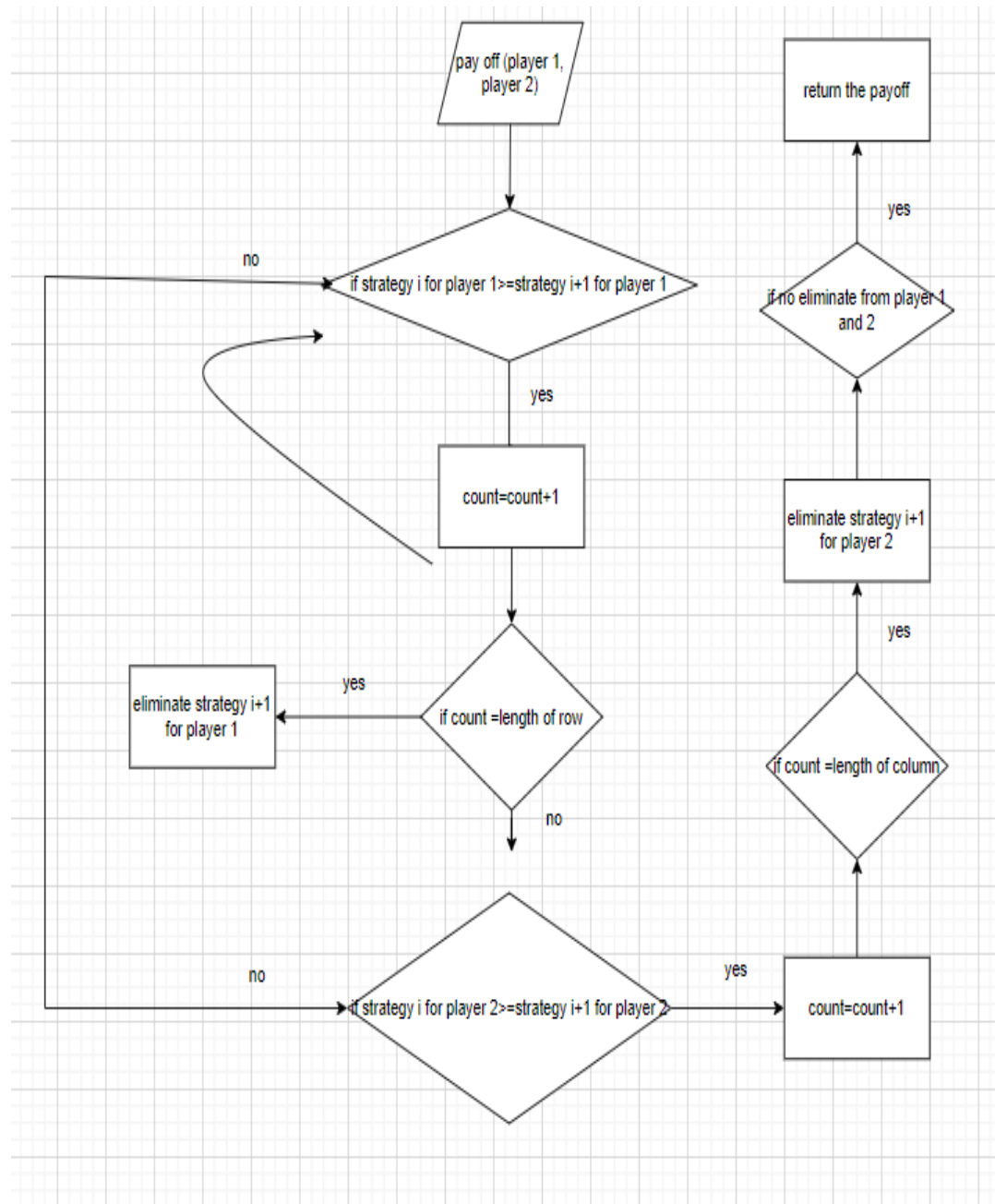# Part 2

1. A strictly dominated strategy is a strategy that always delivers a worse outcome than an alternative strategy, regardless of what strategy the opponent chooses.

2. A weakly dominated strategy is a strategy that delivers an equal
   or worse outcome than an alternative strategy.

3. A pure-strategic approach When every other player j follows aj, Nash equilibrium is an action profile with the feature that no one player I may receive a larger reward by doing an action other than ai. A pure-strategic approach When every other player j follows aj, Nash equilibrium is an action profile with the feature that no one player I may receive a larger reward by doing an action other than ai.
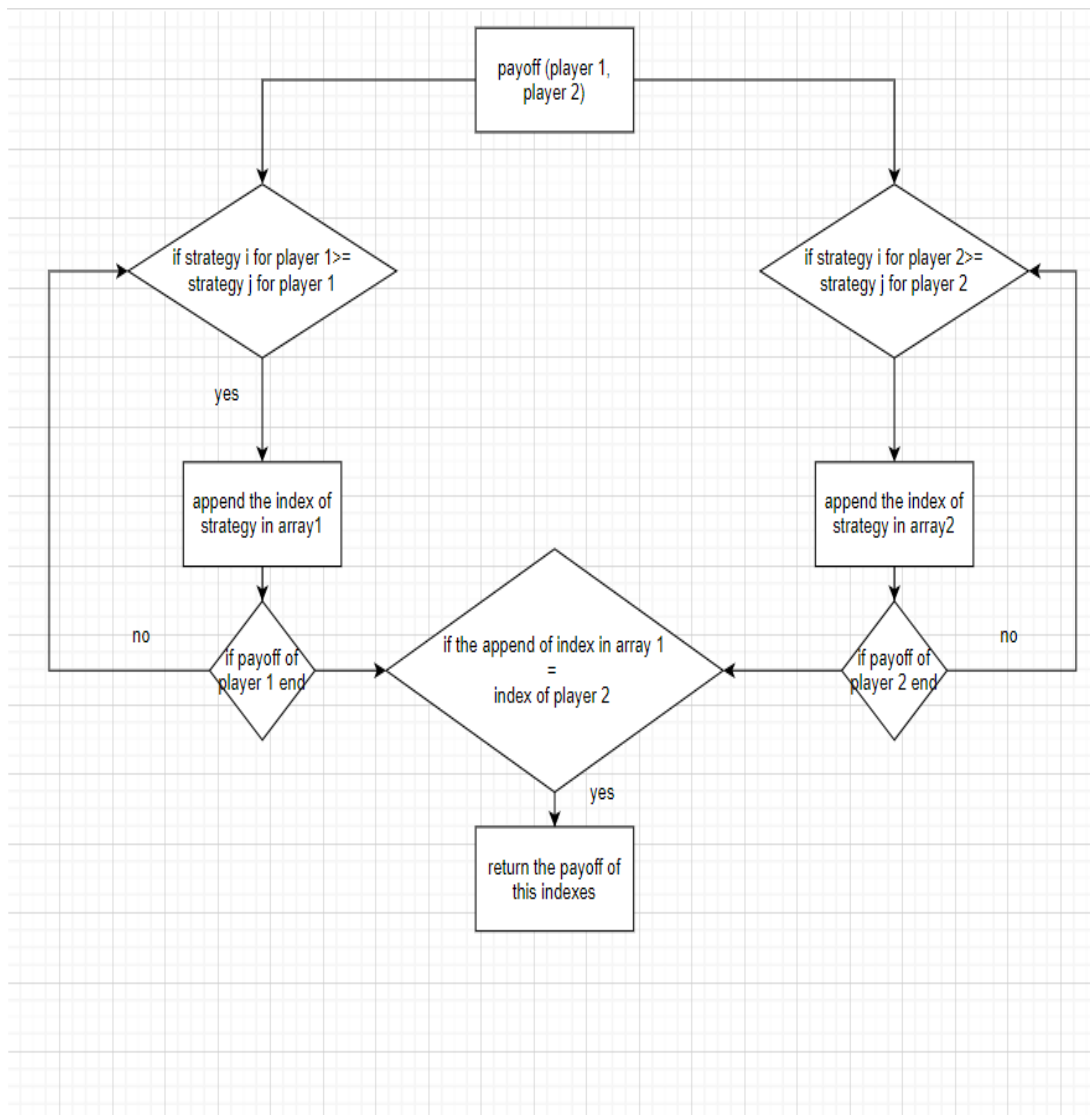
4. strict Nash equilibrium requires that all such deviations be costly.
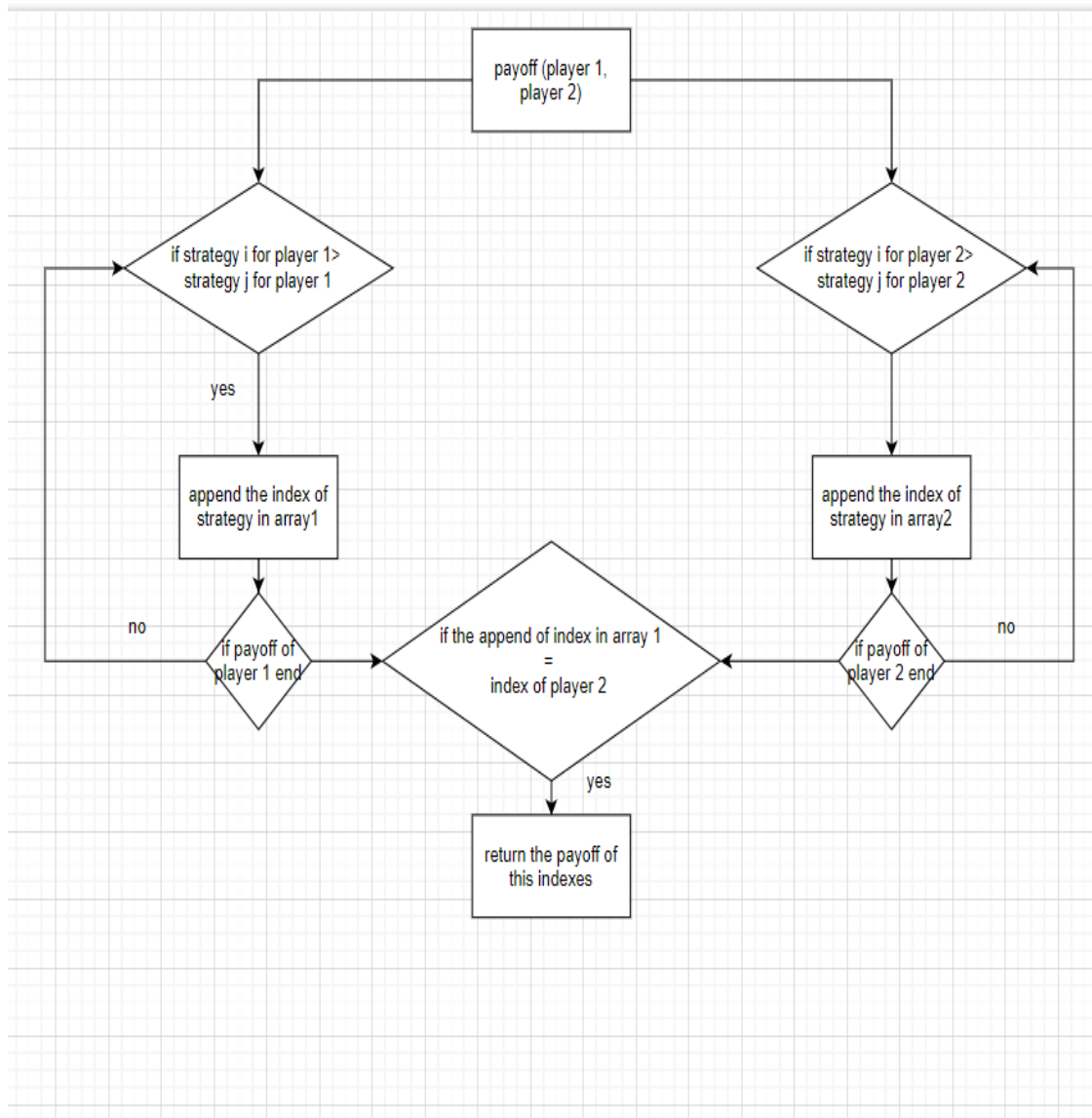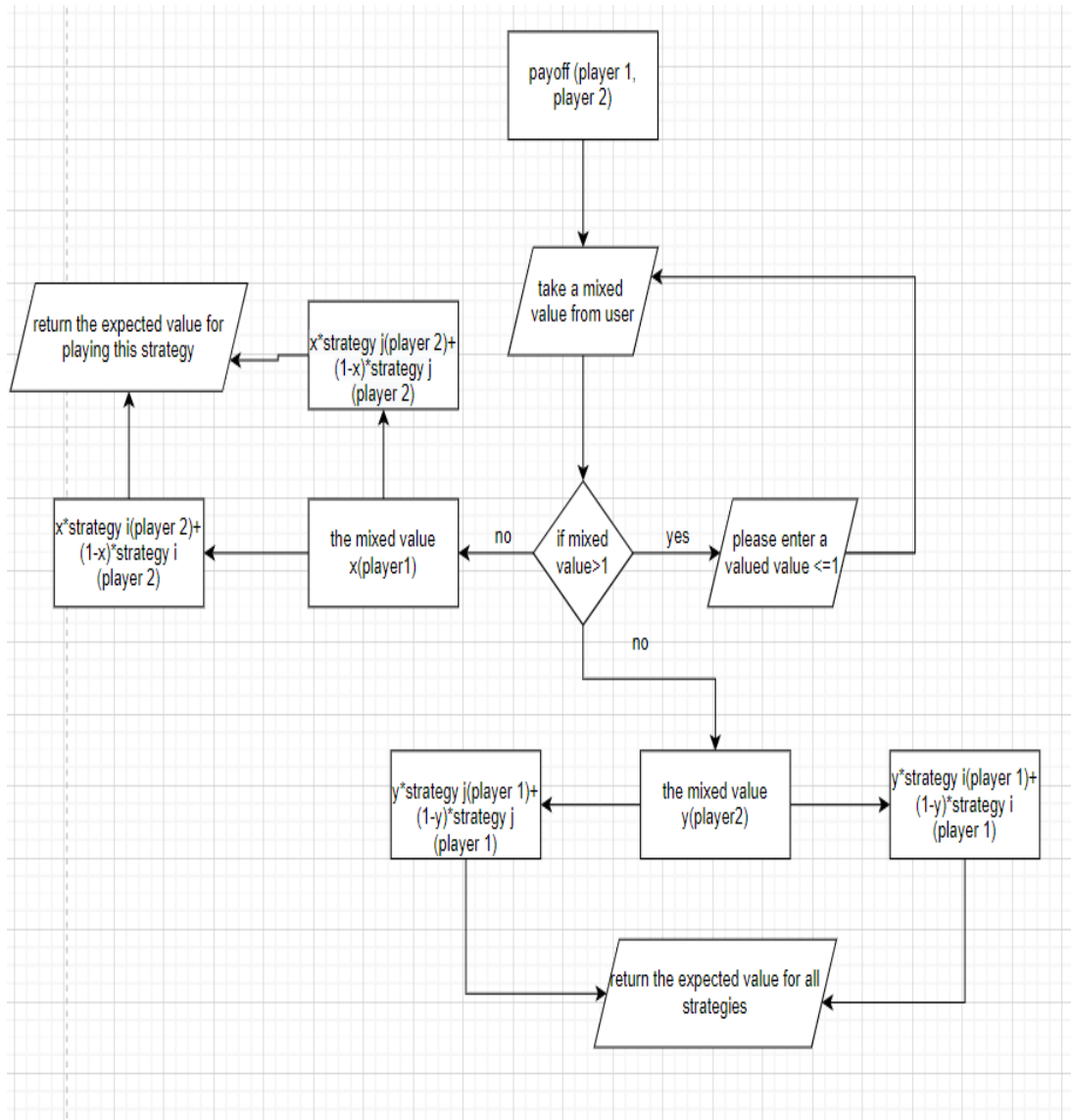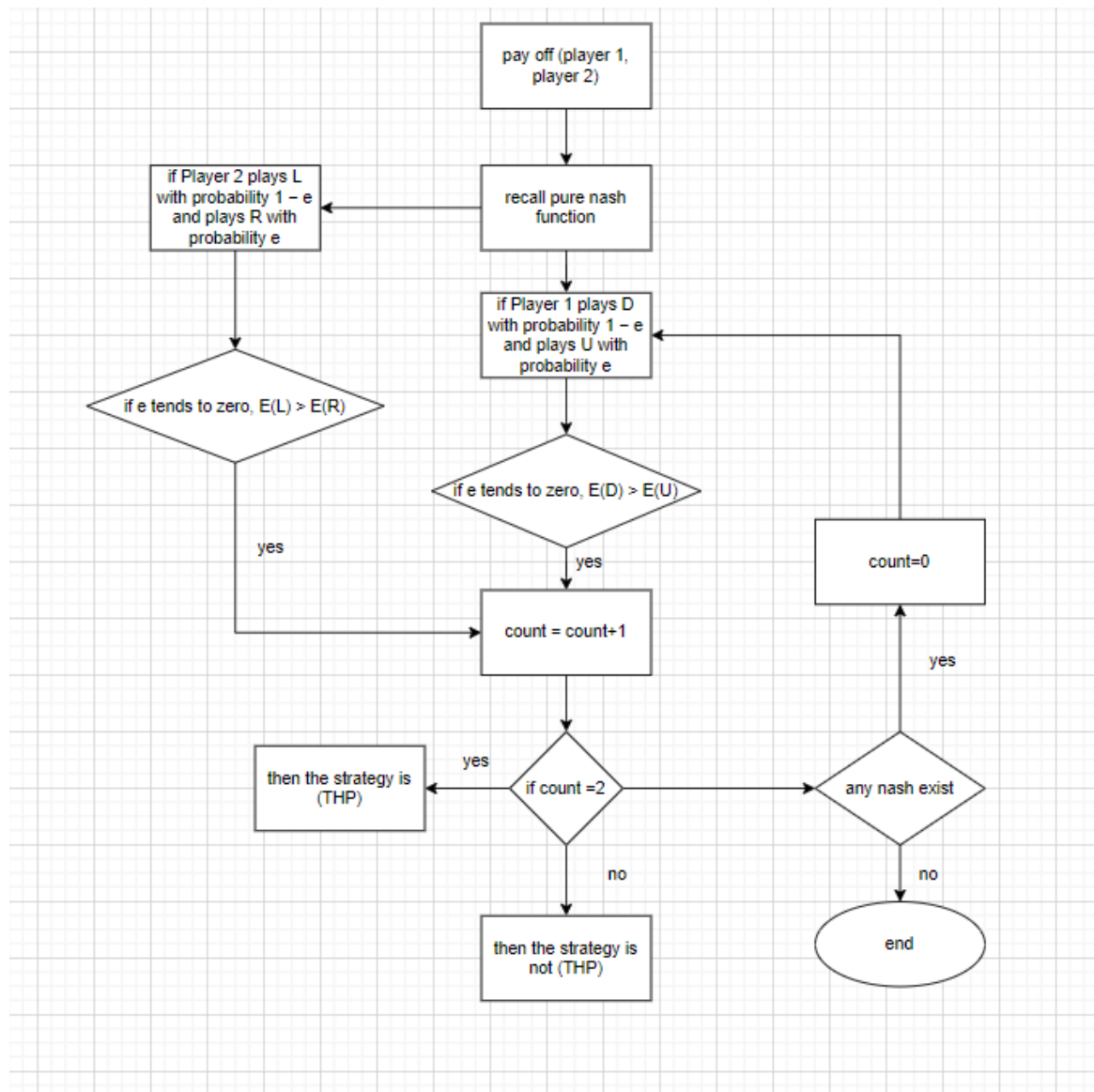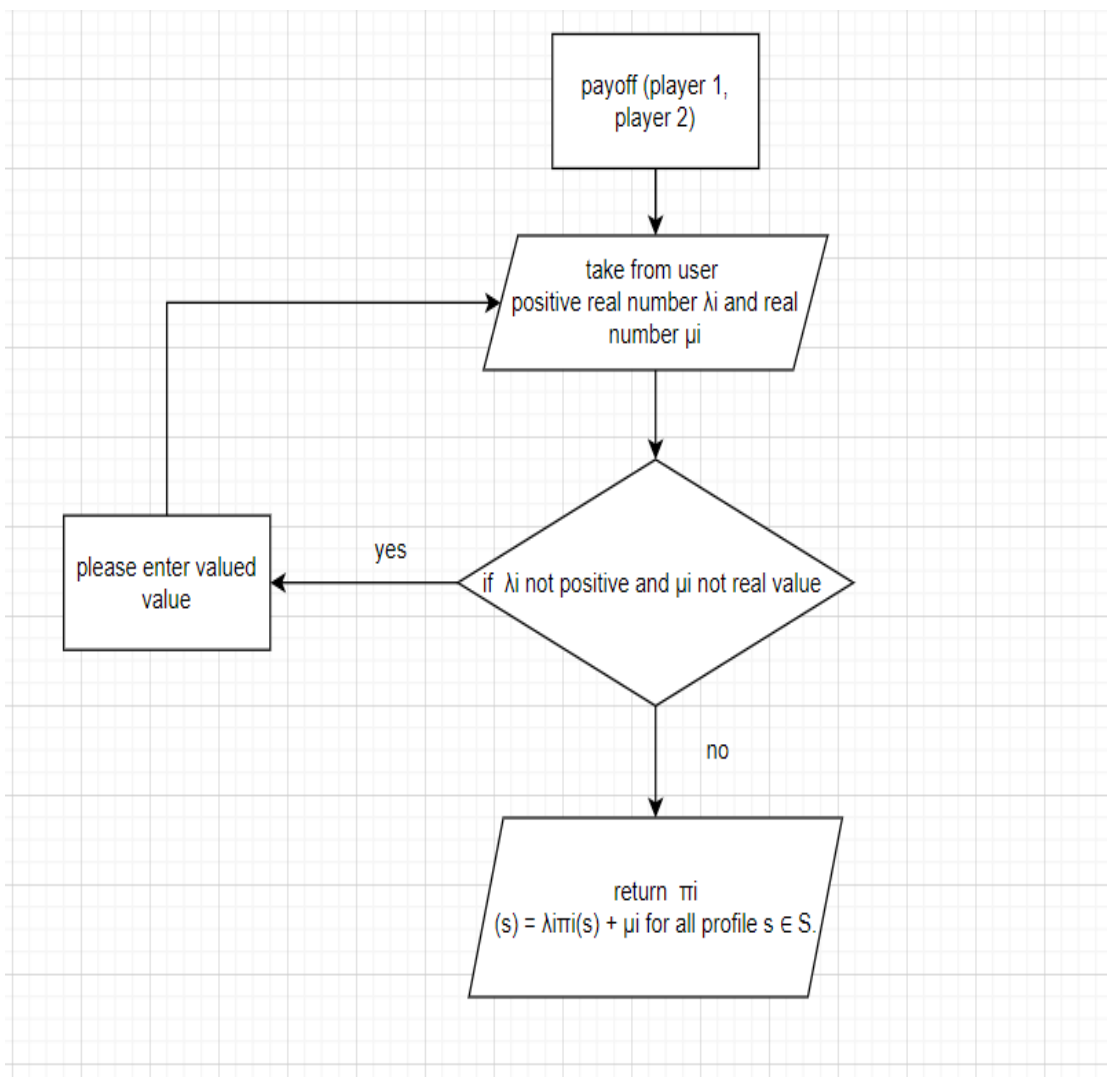
5. Expected payoff: Each player calculates what he will play by calculating the amount of the other player's game in certain proportions.
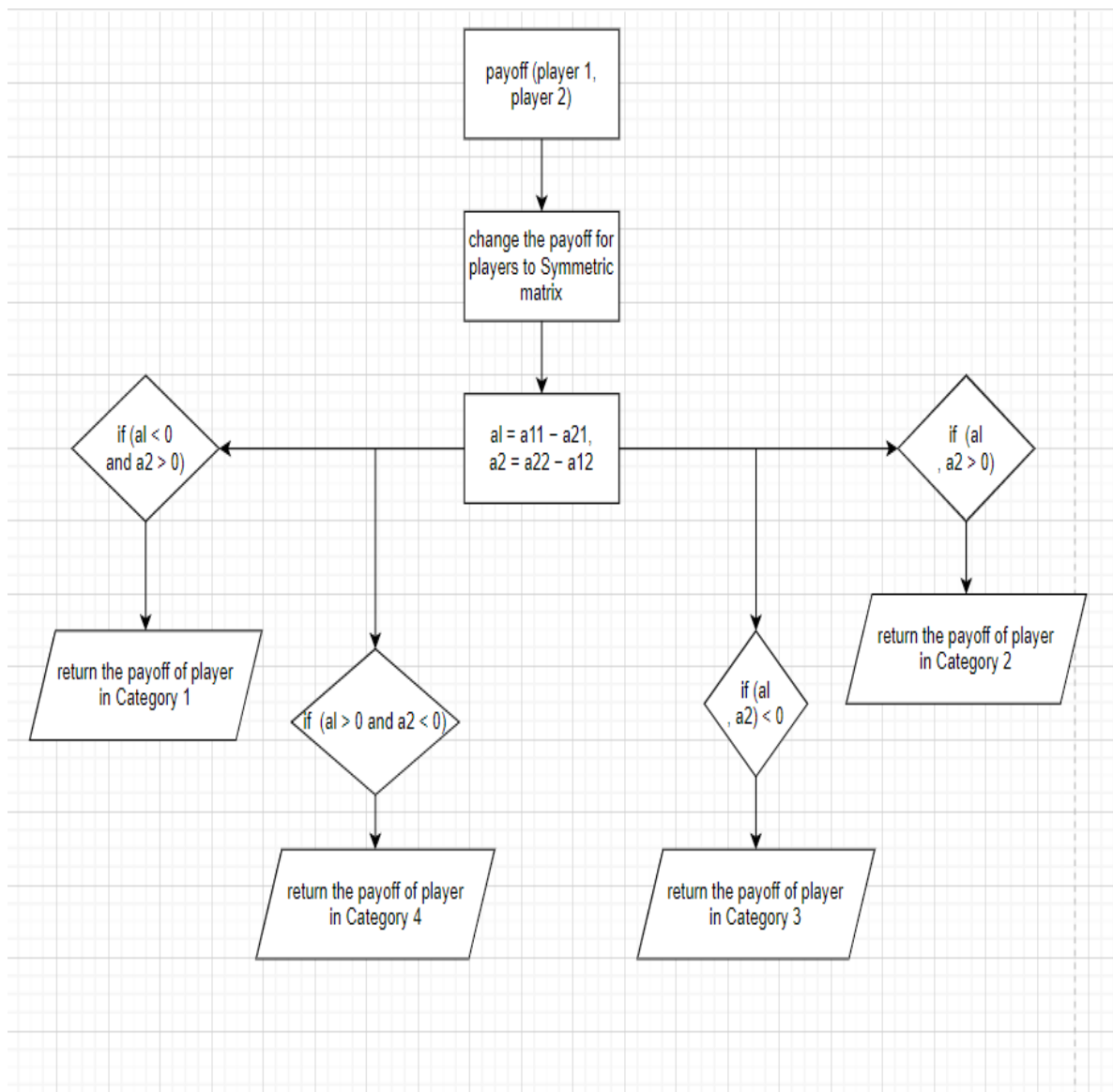
6. The trembling hand Perfect equilibrium, as defined in game theory, is a scenario or state that takes into account the probability of a player making an unintentional move by accident. The chances of this sort of game happening are quite slim, thus deciding whether or not to use this notion in such a situation might be difficult. A refinement of the Nash equilibrium gave rise to this notion.

```
                                    ┌──────────────┐
                                    │ pay off (player 1,│
                                    │   player 2)  │
                                    └──────┬───────┘
                                           │
  ┌──────────────────┐            ┌──────────────┐
  │ if Player 2 plays L│◄─────────│ recall pure nash│
  │ with probability 1 – e│        │   function   │
  │ and plays R with  │            └──────┬───────┘
  │  probability e   │                    │
  └────────┬─────────┘            ┌──────────────┐
           │                      │ if Player 1 plays D│◄──────────────┐
           │                      │ with probability 1 – e│            │
           │                      │ and plays U with │                 │
           │                      │  probability e   │                 │
           ▼                      └──────┬───────┘                      │
  ◇ if e tends to zero, E(L) > E(R) ◇    │                              │
           │                             ▼                              │
           │                  ◇ if e tends to zero, E(D) > E(U) ◇       │
           │                             │                   ┌──────────┤
        yes│                          yes│                   │ count=0  │
           │                  ┌──────────────┐               └──────────┘
           └─────────────────►│ count = count+1│                  ▲
                              └──────┬───────┘                yes │
                                     │
  ┌──────────────┐           yes     ▼            ┌──────────────┐
  │then the strategy is│◄────────◇ if count =2 ◇─►│ any nash exist│
  │    (THP)     │                   │            └──────┬───────┘
  └──────────────┘                 no│                 no│
                              ┌──────────────┐        ┌────────┐
                              │then the strategy is│   │  end   │
                              │  not (THP)   │        └────────┘
                              └──────────────┘
```

7. Positive affine transformation: The inferred preference order of a utility function that can be subjected to a positive affine transformation without changing it. The modified utility function U* = a + bU is obtained by applying a positive affine transformation to the initial utility function U, where b > 0. If the utility functions U and U* describe the same set of underlying preferences, the utility function U is cardinal. An anticipated utility function is an example of cardinal utility.

payoff (player 1, player 2)

take from user positive real number λi and real number μi

please enter valued value

yes

if λi not positive and μi not real value

no

return πi
(s) = λiπi(s) + μi for all profile s ∈ S.

8. Symmetric game: A symmetric two-player game G = (I, S, π), one assumes: Two player positions, Each position has the same number of pure strategies, The payoff to any strategy is independent of which player position it is applied to and change the matrix to symmetric matrix by: al = a11 − a21 and a2 = a22 − a12.

```
                    ┌─────────────────┐
                    │  payoff (player 1,│
                    │    player 2)    │
                    └─────────────────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │ change the payoff for│
                    │ players to Symmetric│
                    │     matrix      │
                    └─────────────────┘
                             │
                             ▼
  ◇ if (al < 0        ┌──────────────┐        ◇ if (al
    and a2 > 0) ◄──────│ al = a11 − a21,│──────►   , a2 > 0)
                       │ a2 = a22 − a12 │
                       └──────────────┘
         │                   │                      │
         ▼                   ▼                      ▼
  ▱ return the payoff   ◇ if (al > 0        ◇ if (al      ▱ return the payoff of player
    of player              and a2 < 0)         , a2) < 0      in Category 2
    in Category 1
                           │                      │
                           ▼                      ▼
                    ▱ return the payoff    ▱ return the payoff of player
                      of player               in Category 3
                      in Category 4
```

Run of code:

Example 1: player 1 = $\begin{matrix} 3 & 0 \\ 5 & 1 \end{matrix}$, player 2 = $\begin{matrix} 3 & 5 \\ 0 & 1 \end{matrix}$

```
Enter the number of rows:2
Enter the number of columns:2
Enter the entries player 1 by row:
3
0
5
1
Enter the entries player 2 by row:
3
5
0
1
[[3, 0], [5, 1]]
[[3, 5], [0, 1]]

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit
```

```
Enter your choice:1
([1], [1])

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:2
([1], [1])

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit
```

```
8-categoty of players
9-Exit

Enter your choice:4
[[1, 1]]

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:5
enter a mixed strategy x for player 1 less than or equal 1:
1.2
please enter valid value
enter a mixed strategy x for player 1 less than or equal 1:
.4
enter a mixed strategy y for player 2 less than or equal 1:
.5
player 1 will play strategy 1 by expected value:
1.5
player 1 will play strategy 2 by expected value:
```

```
Enter your choice:5
enter a mixed strategy x for player 1 less than or equal 1:
1.2
please enter valid value
enter a mixed strategy x for player 1 less than or equal 1:
.4
enter a mixed strategy y for player 2 less than or equal 1:
.5
player 1 will play strategy 1 by expected value:
1.5
player 1 will play strategy 2 by expected value:
3.0
player 2 will play strategy 1 by expected value:
1.2000000000000002
player 2 will play strategy 2 by expected value:
2.6

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
```

```
Enter your choice:6
enter the value of mistake (should be a small value <0.05 )
0.07
please enter valued value
enter the value of mistake (should be a small value <0.05 )
.03
[[1, 1]]
the game is trembling hand perfection

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:8
player1 in category 1
player 2 in category 4
```

```
Enter your choice:8
player1 in category 1
player 2 in category 4

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:7
enter λ1:
-3
please enter positive value
enter λ1:
2
enter μ1
3
enter λ2:
4
enter μ2
4
```

```
Enter your choice:7
enter λ1:
-3
please enter positive value
enter λ1:
2
enter μ1
3
enter λ2:
4
enter μ2
4
([[9, 3], [13, 5]], [[16, 24], [4, 8]])

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:9
```

Example 2: player 1 = $\begin{matrix} 7 & 11 & 2 \\ 6 & 0 & 2 \end{matrix}$, player 2 = $\begin{matrix} 4 & 3 & 0 \\ 1 & 2 & 0 \end{matrix}$

```
Enter the number of rows:2
Enter the number of columns:3
Enter the entries player 1 by row:
7
11
2
6
0
2
Enter the entries player 2 by row:
4
3
0
1
2
0
[[7, 11, 2], [6, 0, 2]]
[[4, 3, 0], [1, 2, 0]]

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
```

```
Enter your choice:1
([7], [4])

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:2
([7], [4])

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit
```

```
Enter your choice:3
[[7, 4]]

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:4
[[7, 4]]

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit
```

```
Enter your choice:4
[[7, 4]]

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:5
you entered invalid matrix

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit
```

```
Enter your choice:6
enter the value of mistake (should be a small value <0.05 )
.00
1[[7, 4]]
the game is trembling hand perfection

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:8
you entered invalid matrix
you entered invalid matrix

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
```

```
Enter your choice:8
you entered invalid matrix
you entered invalid matrix

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:7
enter λ1:
2
enter μ1
3
enter λ2:
6
enter μ2
8
([[17, 25, 7], [15, 3, 7]], [[32, 26, 8], [14, 20, 8]])
```

```
Enter your choice:7
enter λ1:
2
enter μ1
3
enter λ2:
6
enter μ2
8
([[17, 25, 7], [15, 3, 7]], [[32, 26, 8], [14, 20, 8]])

1-strictly dominated
2-weakly dominated
3-pure Nash equilibria
4-pure strict Nash
5-expected payoff
6-trembling hand perfect
7-positive affine transformation
8-categoty of players
9-Exit

Enter your choice:9
```