CSE5319-001

SPEC TOPS THEORY / ALGORITHMS

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Q1.

Q(1)	Rock	Paper	Scissors	Spock	Lizard.
Rock	(-1, -1)	(0, 1)	(1, 0)	(0, 1)	(1, 0)
Paper	(1, 0)	(-1, -1)	(0, 1)	(1, 0)	(0, 1)
Scissors	(0, 1)	(1, 0)	(-1, -1)	(0, 1)	(1, 0)
Spock	(1, 0)	(0, 1)	(1, 0)	(-1, -1)	(0, 1)
Lizard	(0, 1)	(1, 0)	(0, 1)	(1, 0)	(-1, -1)

this is correlated equilbrium

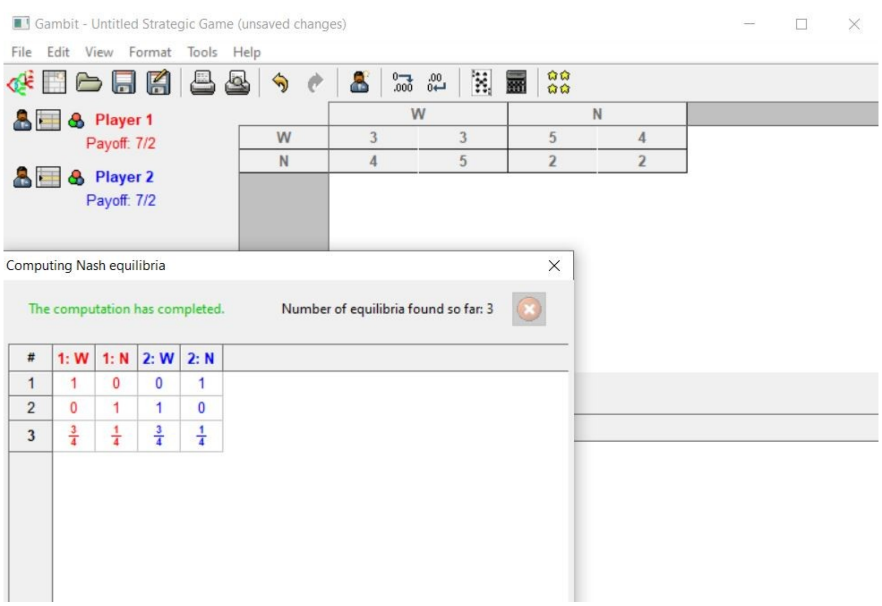
```
a payoff   0.444444 b payoff   0.555556 objective is         1
z distribution is:
 (1 1          0)
 (1 2   0.138889)
 (1 3   0.194444)
 (1 4  0.0555556)
 (1 5          0)
 (2 1          0)
 (2 2          0)
 (2 3          0)
 (2 4  0.0555556)
 (2 5  0.0555556)
 (3 1          0)
 (3 2          0)
 (3 3          0)
 (3 4  0.0555556)
 (3 5  0.0555556)
 (4 1          0)
 (4 2          0)
 (4 3          0)
 (4 4          0)
 (4 5          0)
 (5 1  0.0555556)
 (5 2  0.0277778)
 (5 3   0.194444)
 (5 4   0.111111)
 (5 5          0)
Model has been successfully processed
```

this is coarse correlated equilibria = 0.5

```
a payoff        0.5 b payoff        0.5 objective is          1
z distribution is:
 (1 1          0)
 (1 2        0.5)
 (1 3          0)
 (1 4          0)
 (1 5          0)
 (2 1       0.25)
 (2 2          0)
 (2 3          0)
 (2 4          0)
 (2 5          0)
 (3 1          0)
 (3 2          0)
 (3 3          0)
 (3 4          0)
 (3 5          0)
 (4 1          0)
 (4 2          0)
 (4 3       0.25)
 (4 4          0)
 (4 5          0)
 (5 1          0)
 (5 2          0)
 (5 3          0)
 (5 4          0)
 (5 5          0)
Model has been successfully processed
```

Q2

gambit Nash equilibrium



correlated equilibria

```
a payoff         5 b payoff         4 objective is         9
z distribution is:
 (1 1         0)
 (1 2         1)
 (2 1         0)
 (2 2         0)
Model has been successfully processed
```

Q3
To compute expected cost per agent in mixed Nash equilibrium Roughgarden 178 is modified for six agents with six edges.
***to get the output run the file Q3.cpp in c ++

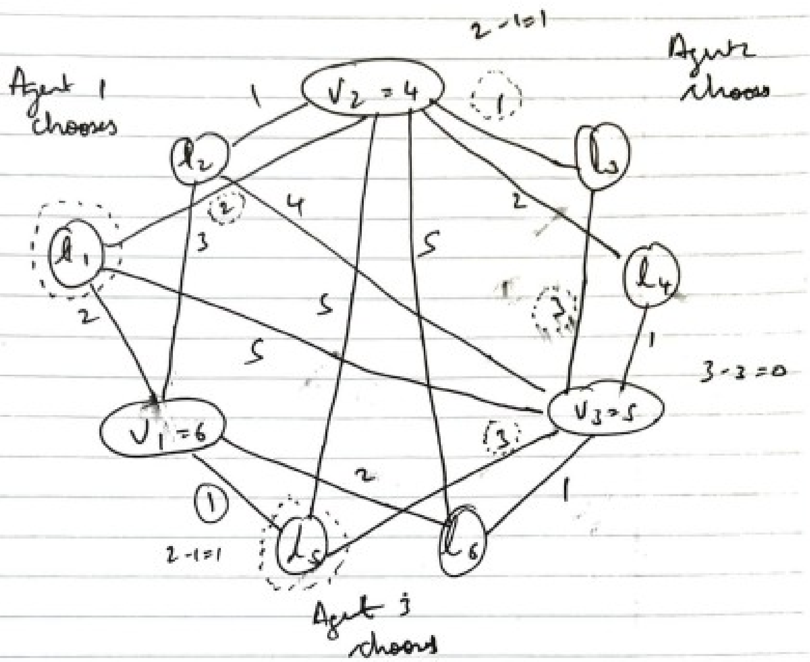
```
// Analyze expected cost per agent for mixed Nash equilibrium.
// Roughgarden, p.178
//Q3 finding expected cost per agent
#include <stdio.h>

int main() {
  int binChoice[6];
  int i,sum=0;
  int ballCount[6];

  // Generate each mapping for 6 agents to 6 edges
  for (binChoice[0]=0; binChoice[0]<6; binChoice[0]++)
    for (binChoice[1]=0; binChoice[1]<6; binChoice[1]++)
      for (binChoice[2]=0; binChoice[2]<6; binChoice[2]++)
        for (binChoice[3]=0; binChoice[3]<6; binChoice[3]++)
                for (binChoice[4]=0; binChoice[4]<6; binChoice[4]++)
                 for (binChoice[5]=0; binChoice[5]<6; binChoice[5]++) {
          // Clear the edges
          for (i=0;i<6;i++)
            ballCount[i]=0;
          // Count agents for each edge
          for (i=0;i<6;i++)
            ballCount[binChoice[i]]++;
          // Accumulate c(x)=x costs
          for (i=0;i<6;i++)
            sum+=ballCount[i]*ballCount[i];
          }
  // 6 agents * number of choices for choosing bin simultaneously
  printf("expected cost per agent= %10.6f\n",((double) sum)/(6*6*6*6*6*6*6));
  }
```

result :

```
Output
/tmp/dDDtCzLBE4.o
expected cost per agent=   1.833333
```

Q4

Q4.)



Agent choice with its payoffs $\pi_i(s)$						$c(s)$	$\sum_{i=1}^{k} \pi_i(s)$
$l_1(1)$		$l_3(1)$		$l_5(0)$		10	2
$l_1(0)$		$l_3(1)$			$l_6(2)$	11	3
$l_1(1)$			$l_4(0)$	$l_5(2)$		11	3
$l_1(0)$			$l_4(0)$		$l_6(0)$	10	0
	$l_2(2)$	$l_3(0)$		$l_5(0)$		10	2
	$l_2(1)$	$l_3(0)$			$l_6(2)$	11	3
	$l_2(2)$		$l_4(1)$	$l_5(2)$		12	5
	$l_2(1)$		$l_4(1)$		$l_6(0)$	11	2