SE LAB 5

NAME: SOURABH PATEL

ADMISSION NO: U19CS082

1. There are four philosophers sitting around a round table. There are forks on the table, one between each pair of philosophers. The philosophers want to eat spaghetti from a large bowl in the center of the table. Unfortunately the spaghetti is of a particularly slippery type, and a philosopher needs both forks in order to eat it. The philosophers have agreed on the following protocol to obtain the forks: Initially philosophers think about philosophy, when they get hungry they do the following:

   - Take the left fork

   - Take the right fork and start eating

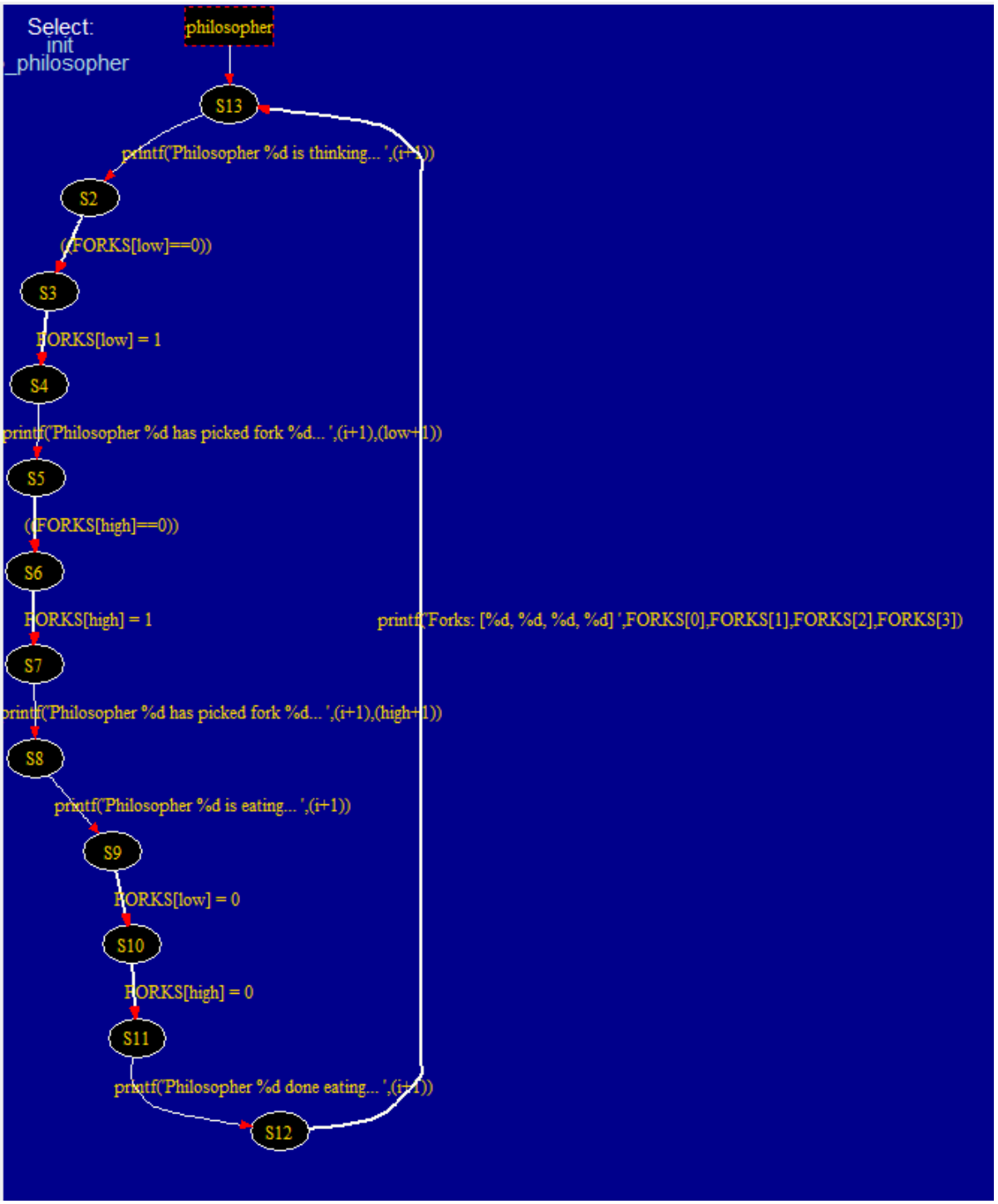
   - Return both forks simultaneously, and repeat from the beginning.

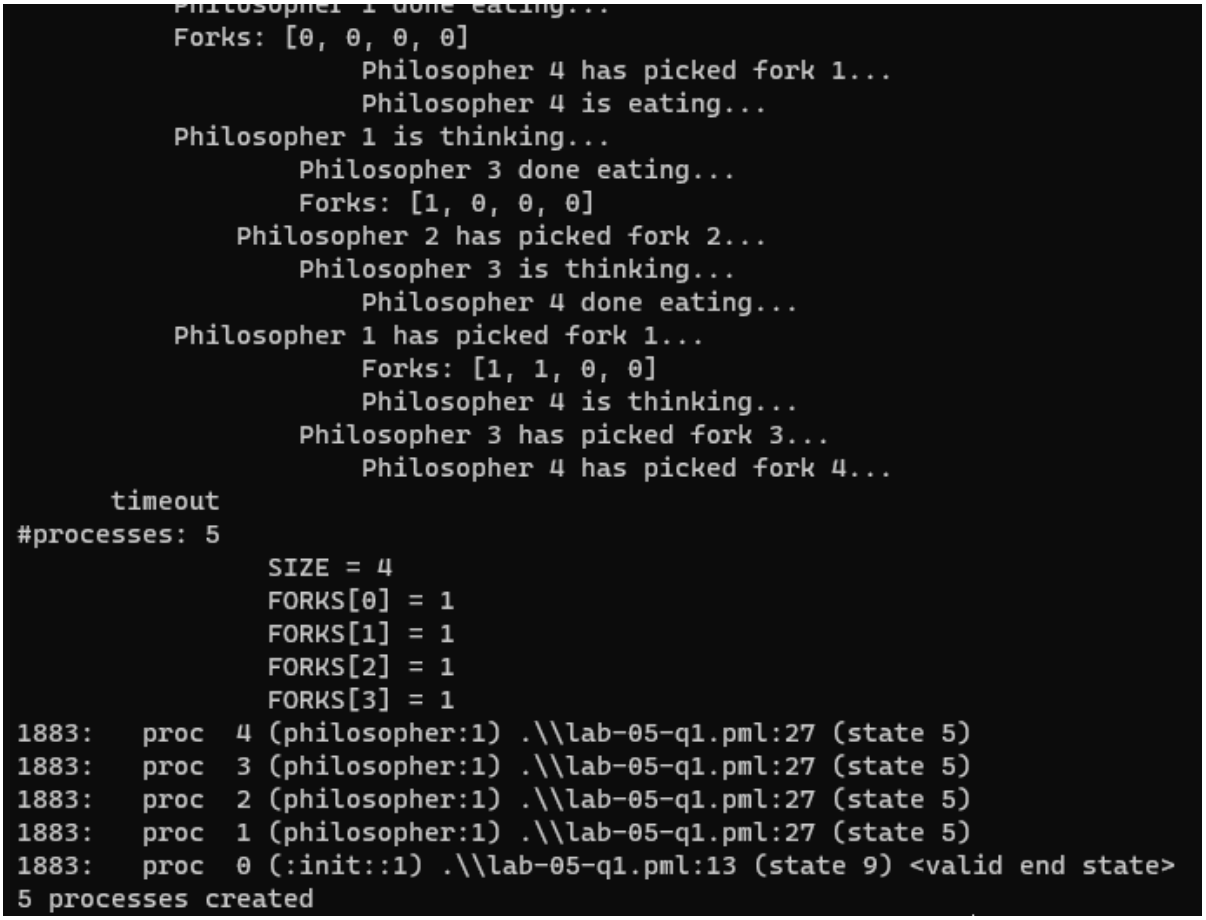
Build a SPIN model for this scenario.

```
int SIZE = 4;
int FORKS[SIZE];


init {
  FORKS[0] = 0
  FORKS[1] = 0
  FORKS[2] = 0
  FORKS[3] = 0
  run philosopher(0);
  run philosopher(1);
  run philosopher(2);
```

```
  run philosopher(3);
}

proctype philosopher(int i) {
  int low = i, high = (i + 1) % SIZE;

  // Graph based ordering for FORK allocation
  if
  :: (i == SIZE - 1) -> low = (i + 1) % SIZE; high = i;
  :: else low = i; high = (i + 1) % SIZE;
  fi

  do
  :: printf("Philosopher %d is thinking...\n", i + 1);
  (FORKS[low] == 0) -> FORKS[low] = 1; printf("Philosopher %d has picked fork %d...\n", i + 1, low + 1);
  (FORKS[high] == 0) -> FORKS[high] = 1; printf("Philosopher %d has picked fork %d...\n", i + 1, high + 1);
  printf("Philosopher %d is eating...\n", i + 1);
  FORKS[low] = 0;
  FORKS[high] = 0;
  printf("Philosopher %d done eating...\n", i + 1);
  printf("Forks: [%d, %d, %d, %d]\n", FORKS[0], FORKS[1], FORKS[2], FORKS[3])
  od
}
```

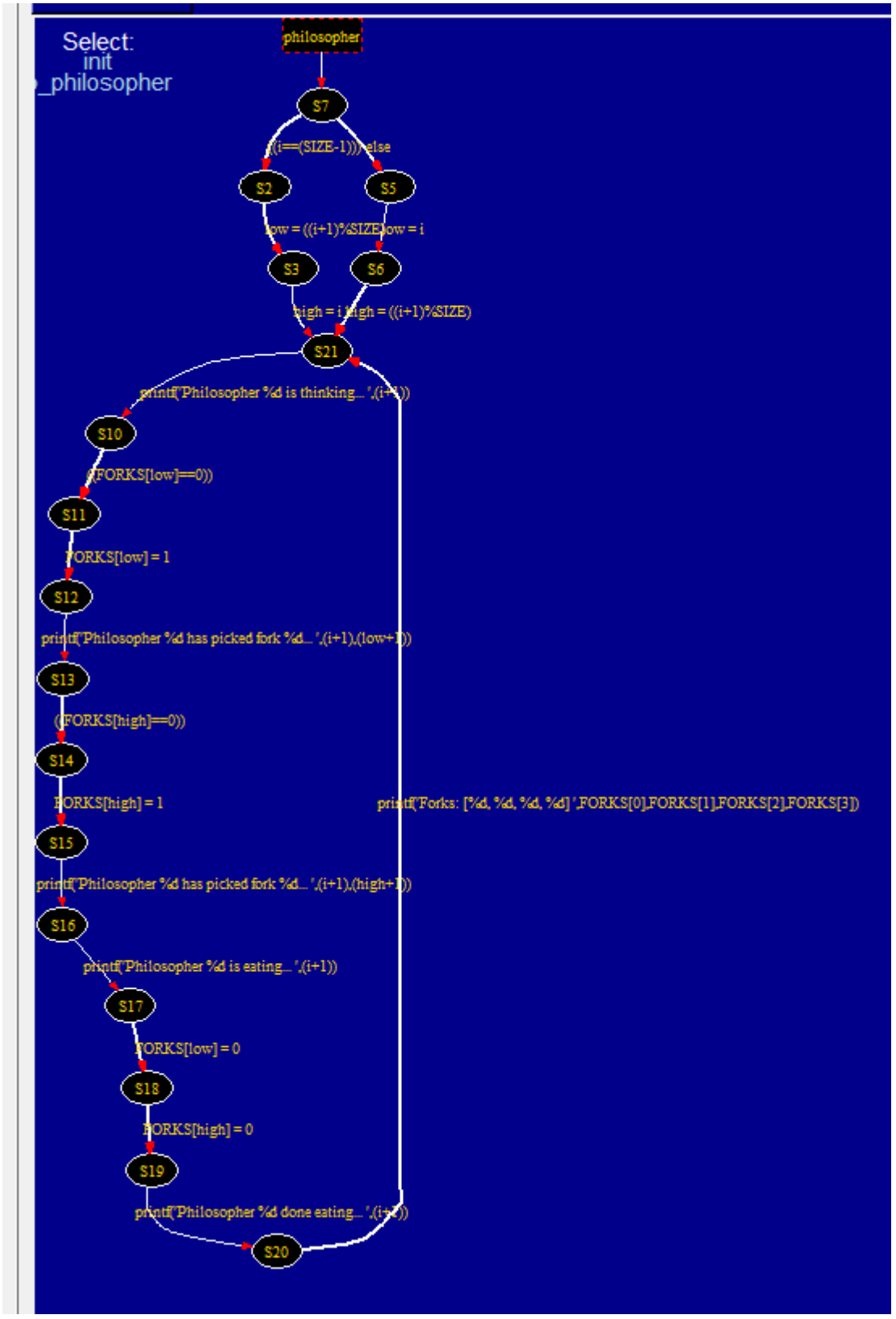
Without Graph-Based Allocation:





Deadlock occurs and the system times out. Each philosopher has one fork.

With Graph-Based Allocation:



No Deadlock! (Infinite loop next page)

```
        Forks: [1, 1, 1, 0]
    Philosopher 2 is eating...
Philosopher 1 has picked fork 2...
Philosopher 1 is eating...
        Philosopher 3 is thinking...
    Philosopher 2 done eating...
    Forks: [0, 0, 1, 0]
    Philosopher 2 is thinking...
        Philosopher 3 has picked fork 3...
Philosopher 1 done eating...
Forks: [0, 1, 1, 1]
    Philosopher 2 has picked fork 2...
Philosopher 1 is thinking...
            Philosopher 4 has picked fork 1...
        Philosopher 3 has picked fork 4...
        Philosopher 3 is eating...
    Philosopher 2 has picked fork 3...
        Philosopher 3 done eating...
    Philosopher 2 is eating...
        Forks: [1, 1, 1, 1]
        Philosopher 3 is thinking...
            Philosopher 4 has picked fork 4...
            Philosopher 4 is eating...
        Philosopher 3 has picked fork 3...
    Philosopher 2 done eating...
            Philosopher 4 done eating...
            Forks: [0, 0, 1, 0]
    Forks: [0, 0, 1, 0]
            Philosopher 4 is thinking...
        Philosopher 3 has picked fork 4...
        Philosopher 3 is eating...
Philosopher 1 has picked fork 1...
    Philosopher 2 is thinking...
        Philosopher 3 done eating...
        Forks: [1, 1, 0, 0]
        Philosopher 3 is thinking...
    Philosopher 2 has picked fork 2...
    Philosopher 2 has picked fork 3...
        Philosopher 3 has picked fork 3...
Philosopher 1 has picked fork 2...
    Philosopher 2 is eating...
Philosopher 1 is eating...
    Philosopher 2 done eating...
    Forks: [0, 0, 0, 1]
Philosopher 1 done eating...
        Philosopher 3 has picked fork 4...
        Philosopher 3 is eating...
    Philosopher 2 is thinking...
Forks: [1, 0, 0, 1]
            Philosopher 4 has picked fork 1...
```