**Name : Abdelrahman shams eldin mohamed (40)**

# OS LAB #3
BATMAN

- # Major functions:
  - BatsManager() : this function used to detect and resolve deadlocks ,its basically calls check() while there still BATs available.
  - BatRoutine() : this function calls our three main functions arrive,cross and leave.
  - Check() : this function checks for deadlock its algorithm is very straight forward : for all directions we have if there at least one BAT in that direction(if there at least one BAT in each direction) then the deadlock happened we solve it by signaling north BAT to cross and leave .
  - Arrive() : increments the direction counter and waits for the direction queue.
  - Cross() : it's used to wait until the BAT from the right cross
  - leave() : used to signal awaiting BAT on the left , also it's used to signal awaiting BATs in its direction queue.

- # Program flow:
  - ➢ First we take the input ,then validate it (trimming chars that we don't expect) ,then create manager thread which calls check while there is existing available BATs , then create thread for each BAT based on the input after validation ,every BAT thread calls arrive,leave,and cross.

- **Sample Runs:**

  - **Sample run#1:**

```
ab_shams@AB-Shams-HP:~/Desktop$ ./bat.o
nsewwewnnnnnnnnnnwesaesewesew
input after validation : nsewwewnnnnnnnnnnwesesewesew
number of BATs : 27
BAT 1 from NORTH arrives at crossing
BAT 1 from NORTH crossing
BAT 1 from NORTH leaving crossing
BAT 4 from WEST arrives at crossing
BAT 4 from WEST crossing
BAT 4 from WEST leaving crossing
BAT 5 from WEST arrives at crossing
BAT 5 from WEST crossing
BAT 5 from WEST leaving crossing
BAT 6 from EAST arrives at crossing
BAT 6 from EAST crossing
BAT 6 from EAST leaving crossing
BAT 10 from NORTH arrives at crossing
BAT 10 from NORTH crossing
BAT 10 from NORTH leaving crossing
BAT 11 from NORTH arrives at crossing
BAT 11 from NORTH crossing
BAT 11 from NORTH leaving crossing
BAT 15 from NORTH arrives at crossing
BAT 15 from NORTH crossing
BAT 15 from NORTH leaving crossing
BAT 17 from WEST arrives at crossing
BAT 17 from WEST crossing
BAT 17 from WEST leaving crossing
BAT 19 from SOUTH arrives at crossing
BAT 19 from SOUTH crossing
BAT 19 from SOUTH leaving crossing
BAT 22 from EAST arrives at crossing
BAT 22 from EAST crossing
BAT 22 from EAST leaving crossing
BAT 25 from SOUTH arrives at crossing
BAT 25 from SOUTH crossing
BAT 25 from SOUTH leaving crossing
BAT 3 from EAST arrives at crossing
BAT 3 from EAST crossing
BAT 3 from EAST leaving crossing
BAT 7 from WEST arrives at crossing
BAT 7 from WEST crossing
BAT 7 from WEST leaving crossing
BAT 12 from NORTH arrives at crossing
BAT 12 from NORTH crossing
BAT 12 from NORTH leaving crossing
```

```
BAT 14 from NORTH arrives at crossing
BAT 14 from NORTH crossing
BAT 14 from NORTH leaving crossing
BAT 20 from EAST arrives at crossing
BAT 20 from EAST crossing
BAT 20 from EAST leaving crossing
BAT 23 from WEST arrives at crossing
BAT 23 from WEST crossing
BAT 23 from WEST leaving crossing
BAT 26 from EAST arrives at crossing
BAT 26 from EAST crossing
BAT 26 from EAST leaving crossing
BAT 2 from SOUTH arrives at crossing
BAT 2 from SOUTH crossing
BAT 2 from SOUTH leaving crossing
BAT 9 from NORTH arrives at crossing
BAT 9 from NORTH crossing
BAT 9 from NORTH leaving crossing
BAT 18 from EAST arrives at crossing
BAT 18 from EAST crossing
BAT 18 from EAST leaving crossing
BAT 27 from WEST arrives at crossing
BAT 27 from WEST crossing
BAT 27 from WEST leaving crossing
BAT 8 from NORTH arrives at crossing
BAT 8 from NORTH crossing
BAT 8 from NORTH leaving crossing
BAT 16 from NORTH arrives at crossing
BAT 16 from NORTH crossing
BAT 16 from NORTH leaving crossing
BAT 13 from NORTH arrives at crossing
BAT 13 from NORTH crossing
BAT 13 from NORTH leaving crossing
BAT 24 from EAST arrives at crossing
BAT 24 from EAST crossing
BAT 24 from EAST leaving crossing
BAT 21 from SOUTH arrives at crossing
BAT 21 from SOUTH crossing
BAT 21 from SOUTH leaving crossing
ab_shams@AB-Shams-HP:~/Desktop$
```

## Sample run#2:

```
ab_shams@AB-Shams-HP:~/Desktop$ ./bat.o ssssssssssssswwwwweeeen
input after validation : ssssssssssssswwwwweeeen
number of BATs : 23
BAT 1 from SOUTH arrives at crossing
BAT 1 from SOUTH crossing
BAT 1 from SOUTH leaving crossing
BAT 2 from SOUTH arrives at crossing
BAT 2 from SOUTH crossing
BAT 2 from SOUTH leaving crossing
BAT 4 from SOUTH arrives at crossing
BAT 4 from SOUTH crossing
BAT 4 from SOUTH leaving crossing
BAT 6 from SOUTH arrives at crossing
BAT 6 from SOUTH crossing
BAT 6 from SOUTH leaving crossing
BAT 8 from SOUTH arrives at crossing
BAT 8 from SOUTH crossing
BAT 8 from SOUTH leaving crossing
BAT 12 from SOUTH arrives at crossing
BAT 12 from SOUTH crossing
BAT 12 from SOUTH leaving crossing
BAT 14 from WEST arrives at crossing
BAT 14 from WEST crossing
BAT 14 from WEST leaving crossing
BAT 17 from WEST arrives at crossing
BAT 17 from WEST crossing
BAT 17 from WEST leaving crossing
BAT 19 from EAST arrives at crossing
BAT 19 from EAST crossing
BAT 19 from EAST leaving crossing
BAT 23 from NORTH arrives at crossing
BAT 3 from SOUTH arrives at crossing
BAT 23 from NORTH crossing
BAT 7 from SOUTH arrives at crossing
BAT 9 from SOUTH arrives at crossing
BAT 11 from SOUTH arrives at crossing
BAT 10 from SOUTH arrives at crossing
BAT 13 from SOUTH arrives at crossing
BAT 15 from WEST arrives at crossing
BAT 16 from WEST arrives at crossing
BAT 18 from WEST arrives at crossing
BAT 20 from EAST arrives at crossing
BAT 21 from EAST arrives at crossing
BAT 22 from EAST arrives at crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 5 from SOUTH arrives at crossing
BAT 23 from NORTH leaving crossing
BAT 20 from EAST crossing
BAT 20 from EAST leaving crossing
```

```
BAT 3 from SOUTH crossing
BAT 3 from SOUTH leaving crossing
BAT 15 from WEST crossing
BAT 15 from WEST leaving crossing
BAT 21 from EAST crossing
BAT 21 from EAST leaving crossing
BAT 22 from EAST crossing
BAT 22 from EAST leaving crossing
BAT 7 from SOUTH crossing
BAT 7 from SOUTH leaving crossing
BAT 9 from SOUTH crossing
BAT 9 from SOUTH leaving crossing
BAT 11 from SOUTH crossing
BAT 11 from SOUTH leaving crossing
BAT 13 from SOUTH crossing
BAT 13 from SOUTH leaving crossing
BAT 10 from SOUTH crossing
BAT 10 from SOUTH leaving crossing
BAT 5 from SOUTH crossing
BAT 5 from SOUTH leaving crossing
BAT 16 from WEST crossing
BAT 16 from WEST leaving crossing
BAT 18 from WEST crossing
BAT 18 from WEST leaving crossing
ab_shams@AB-Shams-HP:~/Desktop$
```

## Sample run#3:

```
ab_shams@AB-Shams-HP:~/Desktop$ ./bat.o
nsewwwewnnswewsneswenswesewswne
input after validation : nsewwwewnnswewsneswenswesewswne
number of BATs : 30
BAT 1 from NORTH arrives at crossing
BAT 2 from SOUTH arrives at crossing
BAT 3 from EAST arrives at crossing
BAT 4 from WEST arrives at crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 5 from WEST arrives at crossing
BAT 6 from EAST arrives at crossing
BAT 1 from NORTH crossing
BAT 1 from NORTH leaving crossing
BAT 3 from EAST crossing
BAT 3 from EAST leaving crossing
BAT 2 from SOUTH crossing
BAT 2 from SOUTH leaving crossing
BAT 11 from WEST arrives at crossing
BAT 12 from EAST arrives at crossing
BAT 14 from SOUTH arrives at crossing
BAT 13 from WEST arrives at crossing
BAT 16 from EAST arrives at crossing
BAT 17 from SOUTH arrives at crossing
BAT 18 from WEST arrives at crossing
BAT 19 from EAST arrives at crossing
BAT 20 from NORTH arrives at crossing
BAT 21 from SOUTH arrives at crossing
BAT 22 from WEST arrives at crossing
BAT 23 from EAST arrives at crossing
BAT 25 from EAST arrives at crossing
BAT 26 from WEST arrives at crossing
BAT 27 from SOUTH arrives at crossing
BAT 24 from SOUTH arrives at crossing
BAT 28 from WEST arrives at crossing
BAT 29 from NORTH arrives at crossing
BAT 30 from EAST arrives at crossing
BAT 7 from WEST arrives at crossing
BAT 8 from NORTH arrives at crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 20 from NORTH crossing
BAT 20 from NORTH leaving crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 9 from NORTH arrives at crossing
BAT 10 from SOUTH arrives at crossing
BAT 15 from NORTH arrives at crossing
BAT 4 from WEST crossing
BAT 4 from WEST leaving crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 29 from NORTH crossing
```

```
BAT 29 from NORTH leaving crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 6 from EAST crossing
BAT 6 from EAST leaving crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 14 from SOUTH crossing
BAT 14 from SOUTH leaving crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 5 from WEST crossing
BAT 5 from WEST leaving crossing
BAT 8 from NORTH crossing
BAT 8 from NORTH leaving crossing
BAT 12 from EAST crossing
BAT 12 from EAST leaving crossing
BAT 17 from SOUTH crossing
BAT 17 from SOUTH leaving crossing
BAT 11 from WEST crossing
BAT 11 from WEST leaving crossing
DEADLOCK: BAT jam detected, signalling North to go
BAT 9 from NORTH crossing
BAT 9 from NORTH leaving crossing
BAT 16 from EAST crossing
BAT 16 from EAST leaving crossing
BAT 21 from SOUTH crossing
BAT 21 from SOUTH leaving crossing
BAT 13 from WEST crossing
BAT 13 from WEST leaving crossing
BAT 15 from NORTH crossing
BAT 15 from NORTH leaving crossing
BAT 19 from EAST crossing
BAT 19 from EAST leaving crossing
BAT 23 from EAST crossing
BAT 23 from EAST leaving crossing
BAT 25 from EAST crossing
BAT 25 from EAST leaving crossing
BAT 30 from EAST crossing
BAT 30 from EAST leaving crossing
BAT 27 from SOUTH crossing
BAT 27 from SOUTH leaving crossing
BAT 18 from WEST crossing
BAT 18 from WEST leaving crossing
BAT 24 from SOUTH crossing
BAT 24 from SOUTH leaving crossing
BAT 22 from WEST crossing
BAT 22 from WEST leaving crossing
BAT 10 from SOUTH crossing
BAT 10 from SOUTH leaving crossing
BAT 26 from WEST crossing
BAT 26 from WEST leaving crossing
BAT 28 from WEST crossing
BAT 28 from WEST leaving crossing
```

```
BAT 7 from WEST crossing
BAT 7 from WEST leaving crossing
ab_shams@AB-Shams-HP:~/Desktop$
```