

AIRPORT QUEUE SIMULATION

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1. Set the air arrival probability  
Enter decimal between 0 and 1: .5
  2. Set the ground arrival probability  
Enter decimal between 0 and 1: .3
  3. Set the duration of the simulation  
Enter integer (seconds) between 1 and 20: 10

```
=====
```

----- Elapsed time: 0.00 seconds -----

Flight no. 348 joined the AIR queue.  
Flight no. 865 joined the AIR queue.

2 flights waiting in the air  
0 flights waiting on the ground.

Flight no. 348 is landing  
2 seconds until runway vacancy...

Runway is now vacant.

1 flights waiting in the air  
0 flights waiting on the ground.

----- Elapsed time: 3.00 seconds -----

Flight no. 743 joined the GROUND queue.

1 flights waiting in the air  
1 flights waiting on the ground.

Flight no. 865 is landing  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
1 flights waiting on the ground.

----- Elapsed time: 6.00 seconds -----

Flight no. 514 joined the AIR queue.

1 flights waiting in the air  
1 flights waiting on the ground.

Flight no. 514 is landing  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
1 flights waiting on the ground.

----- Elapsed time: 9.00 seconds -----

0 flights waiting in the air  
1 flights waiting on the ground.

Flight no. 743 is taking off  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
0 flights waiting on the ground.

----- Elapsed time: 12.00 seconds -----

Flight no. 500 joined the AIR queue.

1 flights waiting in the air  
0 flights waiting on the ground.

Flight no. 500 is landing  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
0 flights waiting on the ground.

----- Elapsed time: 15.00 seconds -----

Flight no. 779 joined the GROUND queue.

0 flights waiting in the air  
1 flights waiting on the ground.

Flight no. 779 is taking off  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
0 flights waiting on the ground.

----- Elapsed time: 18.00 seconds -----

Flight no. 424 joined the AIR queue.  
Flight no. 606 joined the GROUND queue.

1 flights waiting in the air  
1 flights waiting on the ground.

Flight no. 424 is landing  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
1 flights waiting on the ground.

----- Elapsed time: 21.00 seconds -----

Flight no. 386 joined the GROUND queue.

0 flights waiting in the air  
2 flights waiting on the ground.

Flight no. 606 is taking off  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
1 flights waiting on the ground.

----- Elapsed time: 24.00 seconds -----

0 flights waiting in the air  
1 flights waiting on the ground.

Flight no. 386 is taking off  
2 seconds until runway vacancy...

Runway is now vacant.

0 flights waiting in the air  
0 flights waiting on the ground.

----- Elapsed time: 27.00 seconds -----

0 flights waiting in the air  
0 flights waiting on the ground.

0 flights waiting in the air  
0 flights waiting on the ground.

## Implementation

I used a linked-list implementation for my airport queue, with the head of the linked list corresponding to the head of the queue. The tail of the linked list corresponds to the tail of the queue.

This is an efficient implementaion because the enqueue(), dequeue(), and getFront() funcitons are all characterized by  $O(1)$ .

## Conclusions:

Simulations with low probabilities like 0.2 did not clog the runways or airways, but saw very little airplanes at all. They were not efficient.

Conversely, simulations with higher probabilities (0.6 or 0.8) processed many more planes but ended up with queues of 5 or 7 planes in the air or on the ground at the end of the simulation.

After running the simulation many times, I concluded that Air Arrival Probability times around 0.5 combined with Ground Arrival Probabilities around 0.3 gave the best results. Enough planes were processed, but it was unlikely to have queues of more than 1 leftover. I gave grounded planes, who had lower priority than planes in flight, a slightly lower probability of showing up at the queue.