

Theoretical Driving Exams

At the centre for theoretical driving exams one wants to renew the process of taking theoretical driving exams as follows.

Each exam is done individually; the duration of an exam is on average 30 minutes, but at most 45 minutes. At the centre 20 candidates can do simultaneously exam. Candidates can make a reservation and pay in advance through the Internet. During the whole day exams can start every 30 minutes (from 8:15 until 16.15). But the planner decides in advance how many positions are available in every time slot of 30 minutes. An example is the following scheme:

Slot	Starting time	Capacity
1	8:15	0
2	8:45	20
3	9:15	16
4	9:45	16
5	10:15	16
6	10:45	16
7	11:15	16
8	11:45	16
9	12:15	0
10	12:45	0
11	13:15	20
12	13:45	16
13	14:15	16
14	14:45	16
15	15:15	16
16	15:45	16
17	16:15	0

Every position that is made available by the planner will be booked (there is a waiting list of candidates). In practice candidates arrive on time; nearly all of them are present between 35 minutes and 5 minutes before the planned examination time. Candidates may start as soon as a position becomes available (thus possibly earlier than the planned time).

The question is: How many positions should the planner make available during every slot of the day? And, given the available slots, what is the probability that a candidate cannot start in time (i.e., the actual starting time is later than the planned one)? This probability should be very small, in any case less than 1%. And if this situation occurs, what are the mean and standard deviation of the waiting time after the planned starting time?