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Simulation and analysis of queuing networks at Basra International Airport using the program R

Salwan Shakir Saleh[a,*], Nada Badr Jarah[a]

[a] *Collage of Management and Economic, University of Basra, Iraq*

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Abstract

Airports are considered a civilized interface that reflects the economic strength of the country and its development, and that Basra International Airport is the second largest airport in Iraq in terms of area, and one of the most important services it provides is to reduce the waiting time at the boarding pass stations and the security check station and passport stamping for foreign trips and to calculate the airport's ability to leave travelers from Basra airport. The simulation was used to find out the ability of Basra Airport to accommodate the number of passengers at peak times of the sequential queuing networks model.

Keywords: Basra International Airport, Simulation, queuing networks, programming language R

1. Introduction

Airports play an important role in the modern economy, as it is considered the most important means of transportation for goods and travelers in terms of safety and speed, as well as a civilized interface that reflects the economic strength and development of countries, Basra airport seeks to provide the best services to travelers and with the possibility of increasing the number of passengers from Basra airport due to the increase in the Iraqi per capita income or the possibility of completing the construction of the great port of Faw, which is reflected in the economic reality and the increase in investments in Basra,[1] It is necessary to make plans in the event of an increase in the number of passengers and to know the possibility of accommodating the airport for travelers and providing the best services so as not to use alternative airports in case the airport falters or provides services less than the neighboring airports. Two main stations are the station for cutting boarding passes and

*Corresponding author
Email addresses: ssalwan86@yahoo.com (Salwan Shakir Saleh), nadabadrjarah@yahoo.com (Nada Badr Jarah)

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the station for security checks and passport stamping in the case of foreign trips [2], To calculate the possibility of the airport for the departure of passengers from Basra airport, it was found through the use of the simulation method that the possibility of Basra airport depends on four scenarios. Between the first station and the second station, the second scenario, if there are 194 passengers, the waiting time may reach an hour and thirty-four minutes, the majority of which is in the second station. As for the third scenario, if the number of passengers is 193 passengers, the waiting time will be 40 minutes, and this time is somewhat acceptable. The fourth scenario is If the number of passengers is 192, the waiting time is 26 minutes, which is the best way to avoid delays between domestic flights. The simulation method was used in the programming language R [3] to model sequential queuing networks.

2. Network queues

It can include the most general designs of service centers for each of the services provided in succession, which is a group of service centers. Complex systems always include queuing networks. Queue network models have diverse applications such as production line stations, assembly, maintenance and repair operations, airport terminals, communication networks and computer sharing systems. As the customer leaving a queue after completing the service may feed other queues. Individual analysis of isolated queues will not give us a complete picture of the network dynamics [4]. Before considering general network models, it examines systems that require the provision of services in a number of successive stages. If the stations are sequentially or sequential, queues in series, queues tandem, that is, when the customer finishes from the first service station, he must pass through the next station and to the last station in the system. The system may allow or not allow waiting for lines for the customer between successive stations. The queuing networks are divided into two main parts [5]:

Open queuing networks:
They are queuing networks that customers access through an external source and then pass through several nodes or stations to receive the service even if the service is received more than once in the same node or station and then leave the network or system. It has two parts:

Front-facing waiting line network.
back feed queuing network [6].

Closed waiting line network.
For the sake of simplicity, we think of a two-station system for the Markov queuing network system only, and it is circulated to the most stations. The customer comes to the service center, the first station, with a Poisson distribution at a rate, arriving at λ. The customer receives the service in the first station in an exponential distribution at a rate of μ_1 and then moves to the next station and the customer receives the service, which is also distributed in an exponential distribution at a rate of μ_2

That is, the model for the first station and the second station is $(M/M/1)$ and the probabilistic value of the two stations is $p(n_1, n_2, t)$.

The equilibrium equations can be written as follows:

$$p'(n_1, n_2, t) = \lambda p(n_1 - 1, n_2, t) + \mu_1 p(n_1 + 1, n_2, t) + \mu_2 p(n_1, n_2 + 1, t) - (\lambda + \mu_1 + \mu_2) p(n_1, n_2, t), \quad n_1, n_2 \geq 1 \tag{2.1}$$

$$p'(n_1, 0, t) = \lambda p(n_1 - 1, 0, t) + \mu_2 p(n_1, 1, t) - (\lambda + \mu_1) p(n_1, 0, t), \qquad n_1 \geq 1 \tag{2.2}$$

$$p'(0, n_2, t) = \mu_1 p(1, n_2 - 1, t) + \mu_2 p(0, n_2 + 1, t) - (\lambda + \mu_2) p(0, n_2, t), \qquad n_1 \geq 1 \tag{2.3}$$

$$p'(0, 0, t) = -\lambda p(0, 0, t) + \mu_2 p(0, 1, t) \tag{2.4}$$

The diagram in Figure 1 represents the transition state between the first station and the second station.

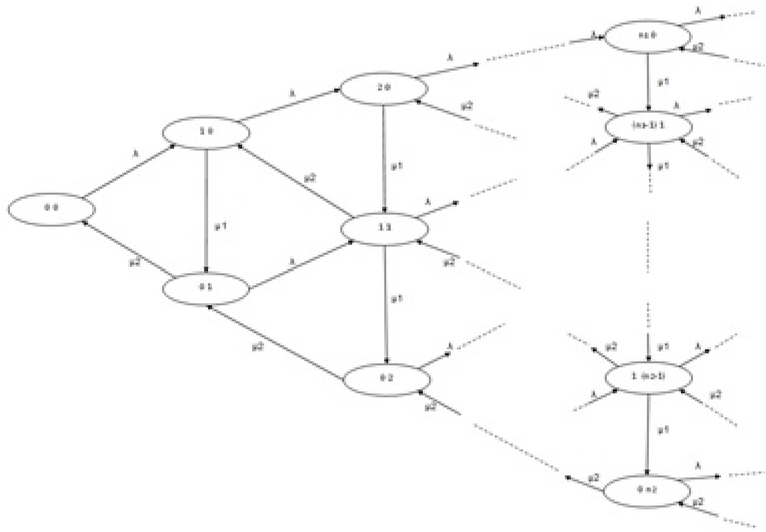

Figure 1: The transition state between the first station and the second station

And the state of stability in each station:

$$\rho_1 = \frac{\lambda}{\mu_1} < 1$$
$$\rho_2 = \frac{\lambda}{\mu_2} < 1$$
$$p(n_1, n_2) = \rho_1^{n_1} \rho_2^{n_2} p(0, 0)$$
$$p(0, 0) = (1 - \rho_1)(1 - \rho_2)$$
$$p(n_1, n_2) = [(1 - \rho_1)\rho_1^{n_1}][(1 - \rho_2)\rho_2^{n_2}]$$

Scientific application

Through field work, passenger arrival data was collected, which depended on the timing of the flights, and that the peak times in most cases start from 5 am to 10 pm, and the arrival of passengers is distributed Poisson distribution at peak times and that the service time in the two stations is distributed exponentially, so it was adopted Simulation method to reduce time and cost and obtain approximate solutions to reality to know the airport's ability to accommodate the number of passengers departing from Basra Airport.

The capacity of each station depends on the number of servers in the station in addition to the average service time. Through field work, the service rate in the first station is 29,903 for each server, which consists of 24 servers. Opening the server depends on the number of passengers, meaning up to 50 passengers opens one server for the time of the trip. The second station has a service rate of 24.333 and consists of 8 servers. Opening the servers also depends on the number of passengers. Opens one server for up to 35 passengers for the time of the trip.
For each station to be stable, the service rate of the stations per hour must be less than the rate of passenger arrivals.

$$\rho_{A1} < 1, \quad \rho_{A2} < 1,$$

The possibility of stability in the first station is 717 passengers per hour, given that there are 24 servers in the first station (29.903). In the second station, it is at 194 per hour, given that there are 8 servers, and the service time is 24.333 in the second station. We conclude through the stability states that the number of entrants to the system should not exceed the possibility of the second station, and that station A2 will be the cause of suffocation if the number of passengers reaches 194 or more. Through the use of the simulation method, we will use four scenarios. The first scenario is that the number of passengers per hour is more than 194 The queues grow very large, and the waiting time tends to infinity over time. The second scenario is that the number of passengers during peak hours reaches 194. The third scenario is that the number of travelers reaches 193. The fourth scenario is that the number of passengers reaches 192, so random numbers were generated to simulate the reality of the arrival of travelers to the scenarios The second, third, and fourth, and the test for independence of random numbers.

```
> x1=runif(194)
> x2=runif(193)
> x3=runif(192)
```

```
> x1
  [1] 0.167715943 0.256641198 0.680992930 0.466007463 0.599307640 0.391451824 0.613473755 0.222260099 0.088178657 0.387098950 0.473572284
 [12] 0.541258867 0.228004366 0.297993744 0.294962107 0.480254668 0.467383035 0.881639843 0.693768006 0.601383876 0.671481058 0.728621945
 [23] 0.934854523 0.388034847 0.316295096 0.725171898 0.410342399 0.731985975 0.862648688 0.792290241 0.614205714 0.287661444 0.256295343
 [34] 0.572889731 0.559468224 0.875947526 0.219908874 0.937126518 0.915891507 0.100825356 0.883702304 0.377467935 0.749652222 0.324196718
 [45] 0.349541653 0.848414327 0.772148052 0.352076096 0.905573216 0.850040769 0.186782881 0.403104887 0.675419657 0.461011339 0.102121773
 [56] 0.073211128 0.428804290 0.049150873 0.918570892 0.309629344 0.139829266 0.535395472 0.005069178 0.560549835 0.571739415 0.375652632
 [67] 0.786919840 0.459150539 0.715281273 0.833767903 0.115098745 0.548848931 0.070294026 0.304711381 0.810851149 0.491013388 0.253473356
 [78] 0.359831521 0.311414330 0.819717255 0.171424234 0.722917535 0.915725975 0.677463438 0.496228868 0.246589590 0.929672656 0.117672232
 [89] 0.589816337 0.348216868 0.665946977 0.227416114 0.334440177 0.986942413 0.842545864 0.112332191 0.484546656 0.784585939 0.737945318
[100] 0.404007140 0.883674107 0.009536464 0.258595711 0.131030775 0.327983468 0.785826550 0.344904061 0.151610538 0.178866904 0.836536039
[111] 0.595796237 0.468381854 0.467585938 0.682125274 0.185285283 0.344062941 0.885630572 0.157738185 0.203104775 0.752559398 0.222669264
[122] 0.147038249 0.991200900 0.933504267 0.694781904 0.233615760 0.044571034 0.785227773 0.426446580 0.461721955 0.396596709 0.870494769
[133] 0.825297103 0.481700304 0.293347091 0.650785748 0.769460176 0.072330904 0.830136472 0.750219584 0.315897495 0.532038418 0.631969950
[144] 0.615774403 0.492485018 0.952952279 0.160301545 0.401486547 0.750412587 0.347738971 0.062199511 0.836671072 0.666781894 0.990717181
[155] 0.421653316 0.503494201 0.635368368 0.535565021 0.453271736 0.160199745 0.131860640 0.391126025 0.956658930 0.663533888 0.854483509
[166] 0.923918381 0.007890795 0.146939037 0.660414869 0.798682903 0.968422999 0.004737428 0.455384799 0.331511616 0.173607097 0.957616162
[177] 0.257607245 0.006441717 0.541986706 0.885669692 0.210396767 0.230402376 0.421629609 0.805606124 0.350848549 0.463520974 0.165954361
[188] 0.257497889 0.237427926 0.202224990 0.404960979 0.633129219 0.316650130 0.049404300

> x2
  [1] 0.1913151480 0.8445855805 0.2935147961 0.3050642305 0.6326482936 0.0031850038 0.4416843455 0.8694806634 0.5367065638 0.9083849809
 [11] 0.7556692623 0.9846618837 0.8463538666 0.4947163328 0.2044240867 0.9313949060 0.5987980524 0.3159519136 0.9820658446 0.7060546009
 [21] 0.8997886684 0.9939417865 0.1661839241 0.1436242976 0.3013123239 0.8357636365 0.2853587426 0.4441145691 0.7086392783 0.9246922135
 [31] 0.1203348872 0.6753367216 0.2255652873 0.3289112863 0.7282511604 0.2315016356 0.3142157490 0.6383668142 0.7238650955 0.4562736177
 [41] 0.4522712298 0.6959612430 0.6553891255 0.9407765493 0.0376548073 0.1634967320 0.7837394809 0.2868450584 0.7439914660 0.4129926593
 [51] 0.0655290452 0.8592853851 0.2392497815 0.5880702948 0.9338705360 0.2293413950 0.5207380669 0.8668217841 0.5897195542 0.7176432381
 [61] 0.4504601434 0.8471663862 0.2653549665 0.0575022425 0.0859865639 0.6265225133 0.5690382072 0.0150621454 0.1125134986 0.3377522123
 [71] 0.5807837204 0.5951554785 0.5983007348 0.5107727519 0.1838081195 0.1864090716 0.7806130305 0.8741415101 0.3582150221 0.3008009077
 [81] 0.5012811585 0.0709067048 0.1618524410 0.9272761124 0.5749671520 0.6935928529 0.3600947012 0.6740608297 0.3061070258 0.0344358268
 [91] 0.5995964147 0.4671975758 0.8554911860 0.8204701266 0.9729413497 0.1801258652 0.4551530653 0.7077407346 0.1615827619 0.8807336339
[101] 0.5061642169 0.1231536681 0.1871614875 0.8486310991 0.2908488002 0.1602892950 0.6599336124 0.2802914381 0.0841841039 0.7941459520
[111] 0.1347542587 0.4401591390 0.7582400425 0.5492634908 0.5091373252 0.0900783602 0.2655587066 0.8199446925 0.6843307891 0.9363252628
[121] 0.2340123432 0.3252139816 0.7784912761 0.1427057129 0.0517372610 0.0745542678 0.0694425078 0.1186736820 0.2386001835 0.9952265993
[131] 0.8688011242 0.7462004796 0.6273956287 0.8103633109 0.8500950963 0.7178800281 0.3833027016 0.3203669782 0.2562195917 0.2702929452
[141] 0.0842224059 0.9388373403 0.4452201994 0.1380816337 0.7886115122 0.5557656710 0.7271793962 0.7030362750 0.5610211231 0.3169985411
[151] 0.5127319312 0.8048250452 0.2405533188 0.7494100432 0.1241189789 0.1216228271 0.1258247034 0.1337397178 0.0173466746 0.6449626421
[161] 0.2977623886 0.3389347466 0.6016767295 0.7858769144 0.4758340428 0.2082558195 0.9861995410 0.6267063844 0.6970868534 0.5843987444
[171] 0.8662960611 0.0746264900 0.8221078685 0.7695115092 0.7661405236 0.9984483044 0.5952461599 0.8242238329 0.6166187057 0.7436335459
[181] 0.7448865336 0.1404220781 0.0003798914 0.1642726299 0.7309936772 0.9927811893 0.2662334642 0.3760268241 0.2125544802 0.4033438840
[191] 0.0987293147 0.4573732968 0.3680588903
```

```
> x3
  [1] 0.659609671 0.765069681 0.427168611 0.343317387 0.288895088 0.989819723 0.486214825 0.410087215 0.226115159 0.176689397 0.304719339
 [12] 0.381804759 0.154132938 0.299734886 0.046043782 0.041332979 0.052753468 0.270390567 0.846315643 0.211321270 0.168506406 0.007861569
 [23] 0.753229415 0.644741788 0.325077238 0.318209363 0.791992736 0.049903997 0.357461357 0.937221680 0.215447188 0.474157434 0.917753151
 [34] 0.010469713 0.207536717 0.919085231 0.890251193 0.549936489 0.193904151 0.085984318 0.761689181 0.147703923 0.097380561 0.111541836
 [45] 0.854427067 0.528329049 0.939079644 0.715922545 0.088708275 0.993963521 0.809815177 0.004194936 0.296596538 0.780900216 0.738333100
 [56] 0.463808436 0.170862361 0.463301959 0.366883046 0.473227832 0.742537072 0.080139724 0.715527346 0.645333377 0.606795811 0.009253138
 [67] 0.586062739 0.630760844 0.394793662 0.860057298 0.927833225 0.313020875 0.280657718 0.776132388 0.760171970 0.424236254 0.843107780
 [78] 0.542346630 0.895801626 0.081888355 0.475513580 0.321784516 0.159429166 0.330288050 0.702676734 0.556462209 0.466163870 0.564980769
 [89] 0.514800432 0.061089185 0.193386995 0.319306596 0.682388065 0.798303004 0.330581661 0.761766408 0.078217576 0.193731632 0.133573683
[100] 0.187222891 0.907396776 0.732124932 0.330720418 0.577032638 0.616808478 0.100904446 0.676919868 0.108631292 0.660920371 0.109661798
[111] 0.898893536 0.588363267 0.435801657 0.437403540 0.312859097 0.124845654 0.414444585 0.569665315 0.989374047 0.640699881 0.808022690
[122] 0.424601211 0.500272427 0.316328490 0.182481613 0.756098337 0.349940698 0.934264577 0.530288515 0.298208009 0.896248346 0.931238473
[133] 0.725909363 0.905716243 0.088095366 0.885736841 0.134144679 0.020745875 0.039570336 0.187566765 0.245930234 0.044533660 0.804053529
[144] 0.836125424 0.474220699 0.635876894 0.191668557 0.012466255 0.599107996 0.659990668 0.043813040 0.042213565 0.992244384 0.687749513
[155] 0.251270973 0.248515398 0.586838339 0.590872455 0.935369360 0.704785077 0.612206853 0.366042616 0.996646056 0.783654664 0.398950377
[166] 0.143287527 0.081312888 0.012054494 0.223429774 0.493496525 0.424896179 0.542123502 0.397226499 0.060418588 0.069530919 0.358403103
[177] 0.844257243 0.260687022 0.083593752 0.869910743 0.392228360 0.087956330 0.724051539 0.457693367 0.081161013 0.835534344 0.064394416
[188] 0.738649475 0.355095157 0.708228081 0.309085614 0.691250689
> y1=c(x1)
> y2=c(x2)
> y3=c(x3)
```

H_0 : Random numbers are independent of each other(Poisson distribution).
H_1 :The generated numbers are not independent (not Poisson distribution).

```
> chisq.test(y1)

        Chi-squared test for given probabilities

data:  y1
X-squared = 30.199, df = 193, p-value = 1

Warning message:
In chisq.test(y1) : Chi-squared approximation may be incorrect
> chisq.test(y2)

        Chi-squared test for given probabilities

data:  y2
X-squared = 32.847, df = 192, p-value = 1

Warning message:
In chisq.test(y2) : Chi-squared approximation may be incorrect
> chisq.test(y3)

        Chi-squared test for given probabilities

data:  y3
X-squared = 36.087, df = 191, p-value = 1
```

Since the p-value is greater than 0.05, the random numbers are independent

```
> Scenario2_1 <- QueueingModel(NewInput.MMC(lambda=194, mu=29.903, c=9))
> CompareQueueingModels(Scenario2_1)
  lambda     mu c  k  m        RO          P0        Lq          Wq   X        L          W        Wqq      Lqq
1    194 29.903 9 NA NA 0.7208493 0.001385044 0.7188699 0.003705515 194 7.206513 0.03714698 0.01331079 3.582294
> Scenario2_2 <- QueueingModel(NewInput.MMC(lambda=194, mu=24.333, c=8))
> CompareQueueingModels(Scenario2_2)
  lambda     mu c  k  m       RO           P0       Lq       Wq   X       L        W      Wqq      Lqq
1    194 24.333 8 NA NA 0.996589 8.331696e-06 288.9433 1.489399 194 296.916 1.530495 1.506024 293.1687
> L_Scenario2 <- Scenario2_1$L+ Scenario2_2$L
> Lq_Scenario2<- Scenario2_1$Lq+ Scenario2_2$Lq
> W_Scenario2<- Scenario2_1$W+ Scenario2_2$W
> Wq_Scenario2<- Scenario2_1$Wq+ Scenario2_2$Wq
> L_Scenario2
[1] 304.1226
> Lq_Scenario2
[1] 289.6622
> W_Scenario2
[1] 1.567642
> Wq_Scenario2
[1] 1.493104
>
```

```
> Scenario3_1<- QueueingModel(NewInput.MMC(lambda=193, mu=29.903, c=9))
> CompareQueueingModels(Scenario3_1)
  lambda     mu c  k  m        RO          P0        Lq          Wq   X        L          W        Wqq      Lqq
1    193 29.903 9 NA NA 0.7171335 0.001437368 0.6899617 0.003574931 193 7.144164 0.03701639 0.01313594 3.535237
> Scenario3_2<- QueueingModel(NewInput.MMC(lambda=193, mu=24.333, c=8))
> CompareQueueingModels(Scenario3_2)
  lambda     mu c  k  m        RO           P0       Lq        Wq   X        L         W       Wqq      Lqq
1    193 24.333 8 NA NA 0.9914519 2.139739e-05 112.7898 0.5844031 193 120.7214 0.6254995 0.6009615 116.9856
> L_Scenario3 <- Scenario3_1$L+ Scenario3_2$L
> Lq_Scenario3<- Scenario3_1$Lq+ Scenario3_2$Lq
> W_Scenario3<- Scenario3_1$W+ Scenario3_2$W
> Wq_Scenario3<- Scenario3_1$Wq+ Scenario3_2$Wq
> L_Scenario3
[1] 127.8656
> Lq_Scenario3
[1] 113.4798
> W_Scenario3
[1] 0.6625159
> Wq_Scenario3
[1] 0.587978
> Scenario4_1<- QueueingModel(NewInput.MMC(lambda=192, mu=29.903, c=9))
> CompareQueueingModels(Scenario4_1)
  lambda     mu c  k  m        RO          P0        Lq          Wq   X        L          W        Wqq      Lqq
1    192 29.903 9 NA NA 0.7134178 0.001491476 0.6621817 0.003448863 192 7.082942 0.03689032 0.01296563 3.489401
> Scenario4_2<- QueueingModel(NewInput.MMC(lambda=192, mu=24.333, c=8))
> CompareQueueingModels(Scenario4_2)
  lambda     mu c  k  m        RO           P0       Lq        Wq   X        L         W       Wqq      Lqq
1    192 24.333 8 NA NA 0.9863149 3.510856e-05 68.90576 0.3588841 192 76.79627 0.3999806 0.3753754 73.07207
> L_Scenario4 <- Scenario4_1$L+ Scenario4_2$L
> Lq_Scenario4<- Scenario4_1$Lq+ Scenario4_2$Lq
> W_Scenario4<- Scenario4_1$W+ Scenario4_2$W
> Wq_Scenario4<- Scenario4_1$Wq+ Scenario4_2$Wq
> L_Scenario4
[1] 83.87922
> Lq_Scenario4
[1] 69.56794
> W_Scenario4
[1] 0.4368709
> Wq_Scenario4
[1] 0.362333
```

The results indicate that in the case of working to the maximum extent possible, it is expected that there will be approximately 304 passengers in the system divided between the two stations. The first station has about 7 people in the system, meaning there is no waiting problem, while in the second station it is expected that there will be 297 passengers in the system, including 289 passengers in the queue waiting for service, and their waiting in the system may take an hour and thirty-four minutes, the majority of which are in the queue of the second station, which is close to An hour and twenty-nine minutes.

While the third scenario, the number of people expected to be in the system is one hundred and twenty-seven passengers, most of whom are in the second station queue, which is estimated at one hundred and thirteen passengers, the waiting time in the network is approximately 40 minutes, most of them are in the second station queue and approximately thirty-seven and a half minutes.

As for the fourth scenario, it shows through data analysis that the number of passengers in the waiting queue network is approximately 84 passengers, most of whom are in the second station queue, which is approximately 69 passengers, and the waiting time is approximately 26 minutes, most of which are in the second station queue and approximately 24 minutes. Through the previous four scenarios, the airport would be able to receive 194 passengers, but every flight is delayed, and this is what makes most travelers resent the waiting queue and the waiting time.

While the fourth scenario is more realistic, because it is possible for all planes to take off without delay, given that the minimum closing time for the first station for each external flight is 45 minutes, while for domestic flights it is 30 minutes, and this is more than the waiting time in the network, which is estimated at 26 minutes.

Figure 2 shows the waiting time in the first station of scenario 2,3,4 waiting time in the first station system and the first station queue.

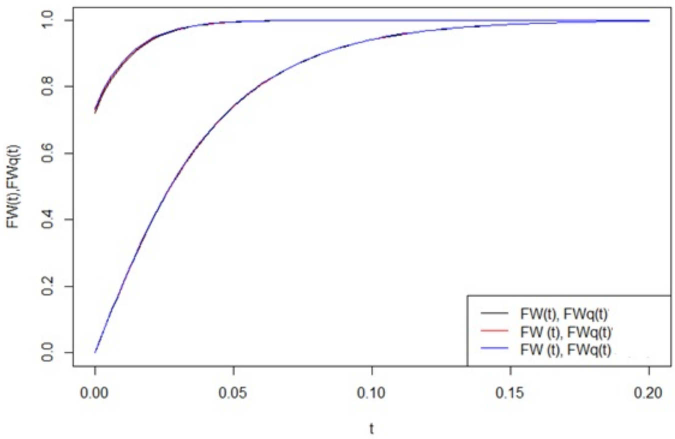

Figure 2: The cumulative distribution function of the system waiting time and queuing for the first station of scenarios 2, 3, 4

From Figure 2, scenarios 2,3,4 seem to be one graph that is highly consistent, that is, there is no difference between scenarios 2,3,4, and the waiting time in the queue is very little.
Figure 3 shows the waiting time in the second station for scenarios 2,3,4, the waiting time in the second station system and the queuing for the same station

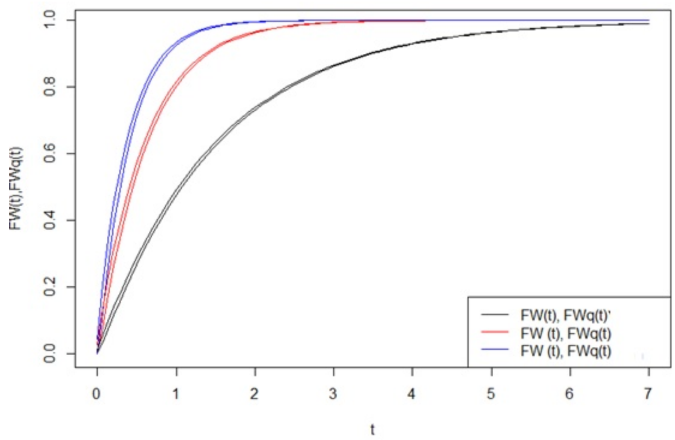

Figure 3: Distribution of waiting time in the system for the second station of time for the three scenarios

From Figure 3, it seems that scenarios 2,3,4 show the big difference between them. In all cases, there is a large waiting time in the queue, so that most of the time that the traveler takes is in the queue.

3. Conclusion

(1) With additional passengers, more pressure comes on airports to improve passenger flow, ensuring that customers are transported around the airport efficiently and queues are reduced. If airports fail to effectively manage the flow of passengers in and out of their terminals, customers will prefer competing airports, resulting in lower revenue and reputational damage.

(2) Networks of successive queues at airports are more general for service centers as the passenger passes through several service stations in order to get on board the plane, and each station contains multiple servers commensurate with the number of actual passengers, which reflects positively on the quality of service provision and reducing waiting time

(3) One of the difficulties many airports face when looking to improve passenger flow is accommodating peak and quiet times.
(4) The use of the R language program gives a wide possibility in statistical analysis and production of graphics

Recommendations

(1) In the case of studying queuing networks, it is recommended to use the simulation method to reduce the time, cost and time, and to develop an appropriate plan for the expected problems before they occur.
(2) Seriously dealing with problems that are expected to occur in the future and setting up an appropriate mechanism to improve services for travelers to ensure their continuity of using the airport itself and not to go to competing airports, which is reflected on the airport's reputation and capacity.
(3) The number of servers in the second station must be increased as a bottleneck, which will improve the waiting time in the queue, which in turn reduces the pressure on the second station.
(4) Through the simulation results, and in the event that the number of passengers has increased to such an extent that the waiting time increases dramatically or the queue grows, the specialized authorities must move to reduce the waiting time through the airport management, which is coordinating the time of landing and take-off of aircraft according to the size of the capacity of each aircraft and its distribution to each hours of the day.
(5) It is recommended to configure a prior security audit program, that is, the traveler informs the security authorities of the date of his trip and his personal information through electronic programs to facilitate the security audit so that it does not take time at the service station.
(6) The actual airport possibility in the absence of delays and the passengers' boarding of the plane is smooth, comfortable and without crowding. The time of closing the system in the first station, which is thirty minutes for domestic flights and forty-five for external flights, must be taken into consideration. In order not to affect internal flights in external flights when the airport allows With 192 passengers per hour, we plan for peak times so that the waiting time does not exceed thirty minutes.

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