Bruce Hao DATA604 Assignment 9

Problem 7.6

Based on the currently scheduling system, the doctor sees fewer than 10 patients on average (out of 24 scheduled), and average wait times are about 30 minutes. Even if she were willing to stay until 12:30pm in case her last appointment was 30 minutes late, she'd still average finishing her last patient visit before noon.

	Sce	nario		Replications		Responses					
	✓ Name		Status	Required	Completed	PatientsSeen	AvgWaitTime (Minutes)	TimeFinished			
٠	V	Scenario 1	Compl	50	50 of 50	9.64	29, 1617	3.371			

It seems like switching to 2-3 patients every 20 minutes isn't that much better. She might see half a more patients per day on average, but wait time goes up to 33 minutes. Sounds like she needs better patients.

	Scenario			Replications		Responses					
	V	Name	Status	Required	Completed	PatientsSeen	AvgWaitTime (Minutes)	TimeFinished			
٠	V	✓ Scenario 1 Compl		50 50 of 50		10.12	33.4541	2.97231			

Problem 7.7

The results below were based on a 10 day experiment with 1 day warm up, using the original setup.

4		100									·		
	Sce	enario		Replications		Responses							
		Name	Status	and the second s	Completed	Routine_TP	Moderate_TP	Severe_TP	Urgent_TP	Routine_WT	Moderate_WT	Severe_WT	Urgent_WT
۰		Scenario 1	Compl	25	25 of 25	1294.52	1010.12	770.8	161.32	18.7963	30.9877	44.0944	76.7767
	-												

The results below were based on a 10 day experiment with 1 day warm up, using the additional severe -> urgent entity.

	DR. CO.	Scenario		Replications		Responses									
						Routine_TP	outine_TP Moderate_TP Severe_TP SevUrg_TP Urgent_TP Routine_WT Moderate_WT						Severe_WT	Severe_WT SevUrg_WT	Urgent_WT
٠	V	Scenario 1	Compl	25	25 of 25	1290.52	1003.16	690.88	79.64	164.56	18.7029	31.1146	44.1713	99.787	77.1332

Throughput is basically unchanged except for the split of severe into severe and severe_urgent. Wait times were basically unchanged, too, except that the new severe_urgent patients definitely waited the longest as a result of having to go through registration and the exam rooms rather than being sent directly to the trauma rooms after sign in.

Problem 7.8

Since the minimum total staffing level is 12 people on shift at all times, we need to cover 12 hours break time per shift or 36 hours per day given 3 shifts per day. Assuming 1) staff only work full-time and 2) 3 regular shifts per day, we need at 2 additional people per shift and 6 additional people per day.

The original model had a constant total capacity of 18, so we'll start by trying the minimum staffing levels for each server to see where utilization is the highest. Then we'll add the 2 people to those servers.

Minimum staffing:

Compared to the original setup, throughput is about the same, but wait times definitely ticked up.

	-			The state of the s		Responses								
	V	Name	Status	Required	Completed	Routine_TP	Moderate_TP	Severe_TP	Urgent_TP	Routine_WT	Moderate_WT	Severe_WT	Urgent_WT	
•	V	Name Scenario 1	Compl	25	25 of 25	1293.44	992.68	783.16	160.76	36.9372	37.6725	47.5619	82.642	

We can also see that utilization is highest in the exam rooms. So we'll add 1 person there, and then re-run.

	11	17	17	1./						
Object Type 🍝	Object Name 🔺	Data Source A	Category -	Data Item 🌲 🖣	Statistic • *	Average	Minimum	Maximum	Half Width	
Server	ExamRooms	[Resource]	Capacity	ScheduledUtilization	Percent	83.8970	81.2996	85.7961	0.4733	
	Registration	[Resource]	Capacity	ScheduledUtilization	Percent	50.0516	48.9293	51.3551	0.2834	
	SignIn	[Resource]	Capacity	ScheduledUtilization	Percent	41.9481	41.2395	42.9027	0.2030	
	TraumaRooms	[Resource]	Capacity	ScheduledUtilization	Percent	31.0888	26.5782	36.0705	1.1039	
	TreatmentRooms	[Resource]	Capacity	ScheduledUtilization	Percent	60.3486	55.7089	63.9166	0.7406	

Minimum staffing + 1 in exam room:

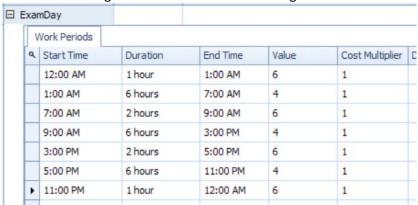
Wait times for routine visits dropped significantly in this case.

	Scenario		Replications		Responses	Responses								
	7	Name	Status	Required	Completed	Routine_TP	Moderate_TP	Severe_TP	Urgent_TP	Routine_WT	Moderate_WT	Severe_WT	Urgent_WT	
		Scenario 1	Compl	25	25 of 25	1305.56	998.64	777	158.56	21, 1534	35.0799	46.3074	81.9484	
- 10									1				1.1	

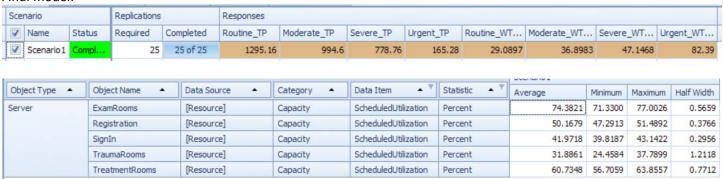
Capacity utilization is still highest in the exam room, so we'll add 1 person there again.

Object Type 🌋	Object Name	Data Source -	Category -	Data Item 🌲 🖣	Statistic • 🖣	Average	Minimum	Maximum	Half Width	
Server	ExamRooms	[Resource]	Capacity	ScheduledUtilization	Percent	67.2190	64.8681	69.8835	0.5080	
	Registration	[Resource]	Capacity	ScheduledUtilization	Percent	50.3705	48.2546	51.8506	0.3859	
	SignIn	[Resource]	Capacity	ScheduledUtilization	Percent	42.1632	40,4591	43.4182	0.3022	
	TraumaRooms	[Resource]	Capacity	ScheduledUtilization	Percent	30.7089	25.4845	35.5476	1.0361	
	TreatmentRooms	[Resource]	Capacity	ScheduledUtilization	Percent	59.9737	55.7545	63.2584	0.7638	

To keep things simple, we'll keep capacity at sign-in, registration, treatment rooms and trauma fixed at the minimum levels of 1, 2, 4 and 1, respectively. We'll then build a work schedule only for the exam rooms, where during each shift, exam room workers will need to cover 12 hours of break time. The schedule below minimizes the number of additional people, but as breaks do not always occur around mid-shift. Some employees will have to take their breaks as early as 1 hour after starting a shift or 1 hour before ending a shift.



Final model:



As for handover time, I'm assuming that although there is 30 minutes of 2 people overlapping, capacity remains constant at 1 person during handover.