Please organize your analysis report as follows.

1. A brief summary of the problem. What is the problem? What is the objective? (10 points)

2. Aggregate Capacity analysis. (Note that you need to consider both the walk-in (60% of all patients) and appointment patients (40% of all patients).) Is there enough capacity? Specifically, are there enough weekly clinicians (physician and NP) hours to satisfy patient demand? (10 points)

Hints: What is the demand over last six months? You can calculate arrival rate per hour from the info (assume the clinic works 40 hours per week). What is the service time? Table 2 give you info that allows you to calculate the average number of Physicians and number of NP's available (number of servers) at any given time.

3. Exhibit 8 shows the number of walk-in patients by hour of day and day of week. For example, 13 patients arrive between 8 and 9 am on Monday. Therefore, if we want to model the first hour with a queuing model (M/M/m), then the arrival rate is 13 patients per hour. Note that Exhibit 8 just gives the demand for walk-in patients. Since you know that 60% of the patients are walk-in and 40% are patients who have appointments, one can come up with a similar table for patients with appointments.

Create the table for hour by hour schedule of clinicians. (10 points)

4. Why are people complaining about waiting too long? One can do an analysis of the queue buildup using Exhibit 8 and Exhibit 1. You know from Exhibit 8, for example, between 8-9 am on Monday, 13 walk-in patients arrive. From Exhibit 1 you know that 3 clinicians (MD + NP) are on duty between 8-9 am (ignore the CA's). So you can figure out how many patients are served in the first hour and how many are not. Those who are not served in the first hour join the arrivals between 9 and 10 am. And so on. One can do a similar analysis for Appointment patients. The analysis will reveal the reason for the long waiting times of walk-in patients. Note this is different from the steady state analysis using the Queueing formula. (10 points)

5. Staffing (20 points)

You can use queuing spreadsheets (in Moodle) to figure out the number of clinicians that are needed to satisfy Joan Carvin's goal of minimizing waiting time. Use the M/M/m model for Walk-ins, and the D/M/m model for Appointment patients. Start by figuring out the minimum number of servers needed. For example, for walk-ins 8-9 on Monday (1/a)=13 patients/hr and we know the average service time p. Since, we require utilization $u<1$, we can solve for the minimum staffing level needed (round-up if you get a fractional number. Plug in the p, a, and m into the queuing model and see what the resulting average waiting time in queue and Pr(wait>45min) are. If the targets cannot be satisfied, increase the number of server by one and check again. Do this for every hour (and every day) for both walk-ins and

appointments. You will now have the correct number of clinicians required at each period. We do have Pr(wait>45min) available for D/M/m in Excel Macro file. You need to think a way to estimate or approximate that measure.

6. Forming teams and recommendations (40 points)

In the above analysis all the clinicians were pooled in one team. The disadvantage of this is that patients may not be able to see their preferred clinician. So Joan Carwin would like to have teams. Having two teams would mean that arrivals are split evenly between with teams (the same with 3 teams, 4 teams, etc.). For example with 2 teams, each team will (13/2)=6.5 walk-ins on Monday 8-9 am. Please try different possibility of forming teams and make a recommendation. How would you evaluate the performance of the proposed team system? Discuss the pros and cons of your proposed team structure.