**Case Study #2: Scheduling in Emergency Department**

After evaluating the arrivals of patients to an emergency department of the Dublin Hospital, the medical director identified the number of doctors needed per each time period. Now, she needs to develop an optimal schedule of doctors assigned to the emergency department.

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| Time | Minimum Number of doctors |
| 9 am - 3 pm | 6 |
| 3 pm - 7 pm | 8 |
| 7 pm – 12 am | 11 |
| 12 am - 9 am | 3 |

Each time period may be covered by staff attendants (full-time doctors) and medical interns (residents) that just finished their medical programs. The attendants have three shifts of 8 hours each, starting from 8 am, 4 pm and 12 am. The interns’ schedule includes two 12-hour shifts starting from 8 am and 8 pm. The hourly cost is $120 per attendant and $32 per intern. Help the medical director to identify the optimal schedule of doctors and interns in the emergency department.

Questions.

1. Formulate an integer programming model that can be used to develop a schedule that will satisfy customer service needs at a minimum total daily cost.
2. Create a spreadsheet model using the formulation from question 1. Solve the model using Excel Solver for the optimal schedule of doctors and interns. Present the optimal schedule and comment on the solution. Will this optimal solution be appropriate for the emergency department? Explain.
3. After reviewing the solution in question 2, the medical director has realized that some additional requirements must be incorporated into the schedule. Specifically, she wants to ensure that at least one attendant is working at any time period. She also wants to hire no more than 5 interns that will be working daily. Revise the model in question 1 by adding required constraints, and incorporate these additional constraints into the spreadsheet model. Solve the revised model, present the new schedule, and comment on the solution.
4. For the optimal model in question 3, use SolverTable to analyze the effect of changing the daily number of interns from 0 to 20 (with an increment of 1) on the minimum total cost, and number of doctors and interns. Present and briefly explain the results of your sensitivity analysis.
5. For the optimal model in question 3, provide a single one- or two-way sensitivity analysis using SolverTable for a parameter(s) of your choice. Present and briefly explain the results of your sensitivity analysis.