**Opening and Operating the Pizza Palace** Save this file as **U5 Pizza Palace**

A new shopping district has recently been developed downtown. Ms. Johnson just purchased a restaurant that is located in the district. She plans to open a pizza eatery and name it Pizza Palace. As owner, Ms. Johnson wants this venture to be as successful and as profitable as possible. She needs to determine how many employees to schedule for a given shift and must keep the wage cost as low as possible.

There are three categories of employee for any given shift: crew members, shift supervisors, and assistant managers.

* Crew members take orders, prepare and cook the pizza, clean the facility, restock materials, and handle customer transactions.
* Shift supervisors perform all of the tasks of crew members. In addition, they supervise, train, and assist the crew members, and aid the assistant manager.
* Assistant managers perform all of the tasks of shift supervisors. In addition, they set the schedules, complete inventory, supervise all workers, manage productivity, make deposits, and settle customer issues. They also direct the operation of the restaurant during their shifts, ensure compliance with company standards, ensure compliance with health and safety codes, maintain fast and accurate service, interview job applicants, and motivate and discipline employees as necessary.

Assistant managers are the most productive employees. Shift supervisors are 80% as productive as assistant managers. Crew members are 75% as productive as shift supervisors.

Ms. Johnson decides on the following pay rates:

* Crew members: $8.00/hr
* Shift supervisors: $10.00/hr
* Assistant managers: $15.00/hr

After thorough research of similar restaurants, Ms. Johnson arrives at some significant conclusions. There are certain necessities for any given shift. In order to have a profitable, safe, and efficiently run eatery,

* There must be at least one assistant manager working each shift.
* The union representing the crew members requires at least seven crew members to work each shift.
* There must be at least one assistant manager or shift supervisor for every five crew members.
* The makeup of any scheduled shift requires a level of productivity equivalent to at least ten assistant managers.

Adhering to the required conditions, how many employees of each category must Ms. Johnson hire for a given shift at Pizza Palace while keeping the wage cost as low as possible?

1. Decision Variables: 3. Constraints:
2. Objective Function:
3. Optimal Solution: 5. Minimal Wage Cost:
4. Identify the binding constraints and indicate why the slack is zero IN CONTEXT of the problem.
5. Identify the nonbinding constraints and indicate what the slack is and what that represents IN CONTEXT of the problem. Be sure to indicate whether this is a true slack or a surplus. *Ignore the # of Assistant Managers and Shift Supervisors to Crew members constraint.*

As Ms. Johnson’s business grows, she finds that her productivity needs change. Pizza Palace now requires that the makeup of any scheduled shift be as include a level of productivity equivalent to twelve assistant managers instead of ten.

1. Use the solver to determine the new optimal solution and minimum wage cost.

Currently, the ratio of assistant managers or shift supervisors to crew members must be no lower than 1:5. Over the first few months, her crew members have become more experienced and need less supervision.

1. Use the solver to learn what happens to the optimal solution if that ratio changes to 1:7; that is, there must be at least one assistant manager or shift supervisor for every *seven* crew members (the productivity constraint should remain at the equivalent of 12 assistant managers, from #8).

What do you think this means about the ratio constraint?

 After three years, the union representing the crew workers negotiates a new contract that stipulates that at least eight crew members must work each shift. Ms. Johnson has kept the changes from #8 and #9.

1. Find the new optimal solution and minimum wage cost. Did the union help out the crew workers with this new contract?
2. The union decided to renegotiate requiring 10 crew members. What would the optimal solution be and minimum wage cost be AND did this help out the crew members?
3. Why MUST this problem solved using integer programming and not linear programming?