### **Problem Description** An accounting firm employs part time workers and full time workers. Full time workers work 8 hours per shift while part time workers work 4 hours per shift. In addition, full time workers are paid \$300 per shift while part time workers are paid \$100 per shift. Currently, the accounting firm has a project requiring 450 hours of labor. If the firm has a budget of \$15000, how many of each type of worker should be scheduled to minimize the total number of workers. **Problem Description**

### **Sets** Set of employee types: $S = \{f, p\}$ Hours per shift: $h_f = 8$ , $h_n = 4$ Wages per shift: $w_f = 300$ , $w_n = 100$ Parameters

**Five-Element Formulation** 

Total labor time required: T = 450Budget: B = 15000Variables | Employees shifts:  $x_f, x_n$ **Objective** Minimize employee number:  $\min_{x_f, x_n} x_f + x_p$ 

Constraints Budget constraint:  $w_f x_f + w_p x_p \le B$ Positive integer constraint:  $x_f, x_n \in \mathbb{Z}^+$ 

## **Five-Element Formulation**

Labor time onstraint:  $h_f x_f + h_p x_p \ge T$ 

### **Generate Solver Code** from pyomo.environ import \*

```
model = ConcreteModel()
model.x f = Var(domain=NonNegativeReals)
model.x p = Var(domain=NonNegativeReals)
```

model.objective = Objective(expr=model.x\_f + model.x\_p, sense=minimize)

 $model.c1 = Constraint(expr=8 * model.x f + 4 * model.x p \ge 500)$  $model.c2 = Constraint(expr=300 * model.x f + 100 * model.x p \leq 15000)$ Optimal Solution Found:

1.1

### **Generate Solver Code**

Optimal Solution Found:

```
from pyomo.environ import *
model = ConcreteModel()
model.x f = Var(domain=NonNegativeIntegers)
model.x p = Var(domain=NonNegativeIntegers
```

Number of Full-Time Shifts (x f): 37

Number of Part-Time Shifts (x p): 39

Total Number of Employees: 76

model.objective = Objective(expr=model.x\_f + model.x\_p, sense=minimize)

 $model.c1 = Constraint(expr=8 * model.x_f + 4 * model.x_p \ge 500)$  $model.c2 = Constraint(expr=300 * model.x f + 100 * model.x p \leq 15000)$ 

Correct Correct definition

# and solution

### Incorrect Number of Full-Time Shifts (x f): 37.5 Number of Part-Time Shifts (x p): 37.5 Missing integer Total Number of Employees: 75.0 constraint