**Jason:**

**4. Enhanced Employee Scheduling Problems**

**4.1 Investigating the Mathematic Model of Which Worker to Lay-off**

We look at an alternative decision to minimize the makespan (or elapsed time), by comparing the outcome of minutes required to complete New Policies and Claims by sending individual workers home. For instance, if either workers 1, 2, or 3, had to take an excused sick absence from work; how this would affect the insurance company and which worker would the insurance company rather have not work. We used the linear programming approach known as Simplex Minimization to tackle the process of determining the most time efficient combination of a particular group of two workers if say, a particular worker were to get sick or be laid off.

We will continue to consider pi and qi, the fraction of New Policy tasks and the fraction of Claim tasks that is assigned to the ith employee, respectively. Our objective function is t, the elapsed time (in minutes) required to complete all the tasks.

**4.1.1 Parameters**

We will also consider all of the average processing times listed in Table 1 to be model parameters.

**4.1.2 Variables**

We will formally define the model variables again.

(Insert chart of 2.1.2 here)

**4.1.3 Constraints**

We know that the constraints for the Mathematics Model of which worker to lay-off is very similar to Basic Model in 2.1.3 as all we are assuming is either worker 1, 2, or 3 will be sent home based on the optimal decision of the insurance company.

**4.1.4 The Objective Function**

In the mathematic approach of finding the optimal situation with which worker the insurance company would prefer to be laid-off or be sick; we will set the productivity function of the sick/laid-off worker to 0 while comparing the minimum time of the other two paired worker to determine which worker is least productive to the insurance company. That is, which pi,qi=0 will minimize the objective function t, subject to all the constraints listed in Table 3.

**4.1.5 Solving the Mathematical Model of which Worker to lay-off or prefer sick**

Using the Linear Programming Simplex Minimization model, there is three new solutions. These results allow us to compare the overall productivity of finishing New Policy and Claims from the insurance company when one of the workers is absent due to sickness or had been laid-off. The absence of worker 3 is most detrimental to the insurance company as the time required to complete all the tasks is greater than the loss of worker 1 and worker 2 respectively, 16.72>16.65,14.87. This also means that the insurance company would prefer to lay-off worker 2 if they had a choice to terminate one employee or prefer worker 2 to be sick as the productivity, even when worker 2 is absent, is the highest compared to if worker 1 or 3 is sick or absent.

The result indicates that worker 1 and 3 are overall more productive than worker 2 in the company as they get accomplish the tasks more time efficiently. With this being said, it would be the insurance companies best interest to keep worker 1 and 3 by possibly offer them slightly higher wages or a salary bonus that would keep them motived with regards to accomplishing their given tasks. It would also be profitable for the insurance company to lay-off worker 2 in hopes of a more productive worker.

**4.1.6 Economic Approach that supports the Mathematical Model**

We propose an alternative model that maximizes every worker’s productivity by assigning them to tasks that they have a comparative advantage on. Comparative advantage is the ability of one worker producing a specific good at a lower marginal and opportunity cost over other workers; even though a worker may be more efficient than other workers in the production of a specific good, their trading and specialization in one good will benefit the whole company.[[1]](#footnote-1) The opportunity cost is the next best alternative to the choice that has been made. [[2]](#footnote-2) Using the approach of comparative advantage, we can show which worker would be preferred to be laid-off or optimal for a firm to have sick-absence with to optimize the time used to complete all the tasks of New Policy and Claims[[3]](#footnote-3).

Variables: mrnp1, mrnp2, mrnp3- minutes required to accomplish New Policy assigned to each employee.

Mrc1, mrc2, mrc3- minutes required to accomplish Claim assigned to each employee.

Opportunity cost of Finishing New Policy: mrnp1, mrnp2, mrnp3- minutes required to accomplish New Policy assigned to each employee

In examining the opportunity cost of finishing both New Policy and Claims; we can determine which workers would be assigned what task, whether to focus on New Policy or Claims. The comparative advantage is when a worker produces a good at a lower cost than someone being compared to.

As you can see from the chart, mrnp/mrc is the opportunity cost of a worker finishing New Policy. Since worker 1 has the lowest opportunity cost compared to workers 2 and 3; 0.357<0.682, 0.722; we can see that worker 1 has a comparative advantage in finishing New Policy.

As you can see from the chart, mrc/mrnp is the opportunity cost of a worker finishing Claims. Since worker 3 has the lowest opportunity cost compared to workers 1 and 2; 1.385<1.467, 2.800; we can see that worker 3 has a comparative advantage in finishing Claims.

The lack of comparative advantage on any task for worker 2 would result in his termination of employment or preferred sickness days compared to workers 1 and 3. The economics model of comparative advantage further supports the linear programming of Simplex Minimization of preferring the combinations of workers 1 and 3 as to any worker with workers 2.

**4.1.7 Cost efficiency of firing workers**

The result of the Linear programing Simplex Minimization approach of comparing time efficiency of laying-off either workers 1,2, or 3 suggest that worker 2 would be the optimal choice as the firm utilizes the least amount of time to accomplish the tasks of New Policy and Claims.

In support of this argument, laying-off workers is beneficial to the insurance company supported by an article from ‘Forbes’. The lay-off process is beneficial when the worker being laid-off is hurting the firm by their inefficiency and unproductivity of prolonging a process in which other potential workers can complete at a faster and more efficient pace. An example used in the article, a productive employee that gets paid a hundred grand a year but brings in two million dollars in business is a relatively small price paid by the company as their contribution is great. This justifies the process of laying-off workers that are not productive as you can potentially hire a more productive worker[[4]](#footnote-4).

**5.1 Investigating the Mathematics Model of Worker’s Happiness**

Another approach that we looked at is the change in productivity as a result from an increase in worker’s happiness. With the approach of determining worker productivity by sending an employee home or simply by lay-off can be rather ruthless and unethical. An alternative approach may be focusing on worker happiness by ensuring every worker has the chance of sharing their ideas during meetings that allow workers to offer their input on changes and policies. Research has shown that engaged employees tend to perform better on the job as compared to workers that have no feeling of contribution to the company[[5]](#footnote-5). In a pronounced company like Google, worker satisfaction is crucial to its company’s success as they focus on implementing complementally provided services, for instance; breakfast, health coverage, gym access, on-site physician, etc.[[6]](#footnote-6). “Obviously, all these perks come at a cost for Google. But so does employee dissatisfaction and high turnover”. Looking at this perspective, we can see that it may also be the right approach to spend a little additional money to ensure that workers are satisfied and motivated to work hard and remain productive.

Using this approach of focusing on worker’s happiness, we assume that worker productivity is increased by 10 percent. We will use the same approach of Linear Programing Simplex Minimization method to determine how the 10 percent productivity increase affects the overall insurance company. We will consider pi and qi, the fraction of New Policy and Claims respectively, assigned to the ith employee.

Our objective function will simply be t, the elapsed time (in minutes) required to complete all tasks, after an 10 percent productivity increase due to the emphasis of the company on worker happiness.

**5.1.1 Parameters**

(Create Table 1.1, 1.2, 1.3)

Table 1.1 Average Task Processing Time (in minutes) after 10 percent increase in productivity of both New Policy and Claim

Worker New Policy Claim

Employee 1 9.0909091… 25.4545454545..

Employee 2 13.63636364. 20.000000000000..

Employee 3 11.81818182. 16.363636363636..

Table 1.2 Average Task Processing Time (in minutes) after 10 percent increase in only New Policy

Worker New Policy Claim

Employee 1 9.0909091… 25

Employee 2 13.63636364. 22

Employee 3 11.81818182. 18

Table 1.3 Average Task Processing Time (in minutes) after 10 percent increase in only Claims

Worker New Policy Claim

Employee 1 10 25.4545454545..

Employee 2 15 20.000000000000..

Employee3 13 16.363636363636..

We will now consider all the average processing time listed in Table 1.1, 1.2, and 1.3 to be the model parameters. The difference is New Policy and Claim’s productivity per worker increase by 10 percent or either each individual task increase by 10 percent.

**5.1.2 Variables**

The model variables are listed in Table 2.

(List Table 2: Basic Model Variables)

**5.1.3 Constraints**

This new model of adjusting for an increase in 10 percent of productivity results in the slight chance of constraints listed in Table 3.1, 3.2, and 3.3. Essentially the constraints are the same as the Basic Model Constraints.

Tab. 3.1: Basic Model Constraint for 10 Percent Productivity Increase in of Both Tasks

P1+p2+p3=1 We must assign exactly all New Policy tasks

Q1+q2+q3=1 We must assign exactly all Claim tasks

9.09p1+25.45q1<=t Ensure minimal makespan

13.64p2+20.00q2<=t Ensure minimal makespan

11.82p3+16.36q3<=t Ensure minimal makespan

Tab. 3.2: Basic Model Constraint for 10 Percent Productivity Increase in New Policy Only

P1+p2+p3=1 We must assign exactly all New Policy tasks

Q1+q2+q3=1 We must assign exactly all Claim tasks

9.09p1+28q1<=t Ensure minimal makespan

13.64p2+22q2<=t Ensure minimal makespan

11.82p3+18q3<=t Ensure minimal makespan

Table 3.3: Basic Model Constraint for 10 Percent Productivity Increase in Claims Only

P1+p2+p3=1 We must assign exactly all New Policy tasks

Q1+q2+q3=1 We must assign exactly all Claim tasks

10p1+25.45q1<=t Ensure minimal makespan

15p2+20.00q2<=t Ensure minimal makespan

13p3+16.36q3<=t Ensure minimal makespan

The constraint is adjusted by an increase in productivity of 10 percent for both tasks or either an increase of 10 percent for new policy or claim tasks only. The first two constraints of each table explain that each task will get assigned to all workers so there is no task left out. The last three constraints ensure that the tasks are allocated to each employee and the elapsed time for each worker does not exceed that of their fellow co-workers.

**5.1.4 The Objective Function**

In this mathematical approach, we examine three circumstances of increase in productivity of the tasks of New Policy and Claims. In the first situation, we look at the optimal time that all three workers would need to complete all tasks given an increase in productivity of 10 percent for both New Policy and Claims. In the second situation, we look at the optimal time it takes for an increase in 10 percent productivity of New Policies only. In the third and final situation, we examine the optimal time of an increase in 10 percent of only Claims. All these situations would be examines given the constraints of Tables 3.1, 3.2, and 3.3 respectively for each situation. That is we will try to minimize the objective function t, given all the constraints listed.

**5.1.5 Solving the Mathematical Models of Increase in Productivity of New Policy and Claims**

Using Linear Programming with the Simplex Minimization mode, we examine all three scenarios discussed in section 5.1.4. The use of free complimentary services from big companies like ‘Google’ can give workers initiative to work harder as they would not want to be laid-off for their low productivity contribution to the company. The insurance company can implement such services to allow its workers to feel acknowledged for their contribution to the company as a result, their increase in productivity for accomplishing New Policies and Claims by 10 percent. This will result reduce the time required by each employee by 10 percent for both tasks. For the time it requires to accomplish New Policies, the time for workers 1,2, and 3 decreased to 9.09, 13.64, and 11.82 respectively. As for the time it requires for workers 1,2, and 3 to accomplish Claims; it decreased to 25.45,20.00, and 16.36 respectively. The time required to accomplish the tasks of New Policies and Claims assigned to each worker reduced from 9.94 minutes or 9.56, to 9.04 minutes or 9.02.

For the second scenario, the increase of 10 percent for only New Policies for each worker is the same as the first scenario. For workers 1,2, and 3; each worker will require 9.09, 13.64, and 11.82 respectively. The only difference is the time required to complete Claims is the same as the Basic Model discussed in section 2. As the time required for workers 1,2, and 3 to complete claims is 28, 22, 18 respectively. This situation can be explained by the circumstance in which the insurance company holds a meeting that allows the employee to be able to provide input and say on policies in which they collectively think is good and the company directing the employee in the right direction in which everyone is on the same page. The meeting can be held in an annual banquet that provides free luxurious food to the employees that make them feel acknowledge and ‘happy’. As a result of this, the time required to accomplish new policies increases by 10 percent as everyone is on the same page. The claim productivity for each employee remains the same because the technology required to process the claims remains the same. As a result of the acknowledgement of workers, the time required to complete all tasks by the workers decreases from 9.94 minutes or 9.56, to 9.69 minutes or 9.41.

For the final scenario, the increase of 10 percent for only Claims for each worker is the same as the first scenario. For workers 1,2, and 3; each worker will require 25.45, 20.00, and 16.36 respectively. The time required to complete New Policies will remains the same as the Basic Model in section 2. This can be easily explained by a technological innovation that allows the workers for the insurance company to process Claims faster than before. This does not necessary mean the insurance company may treat the workers better than before, but the company would spend money to replace all the previous technology of processing Claims that will in turn allow the workers to perform more efficiently in regards to Claims. In result of this, the time required for the workers to complete all the tasks overall for the insurance company decreases from 9.94 minutes or 9.56, to 9.40 minutes or 9.24.

As we can see, the most efficient model is the increase in productivity of 10 percent for both New Policies and Claims. Next is an increase of 10 percent in only Claims and then increase of 10 percent in only New Policies. This suggests that the insurance should focus only on worker happiness by providing complimentary services that allows the workers to feel acknowledged and want to remain employed for the insurance company. This is greatly supported by the example of ‘Google’ being generous to its workers by giving them free services. Or should we view this as smart decision to focus on worker happiness by big companies to keep their workers in working productively.

1. http://en.wikipedia.org/wiki/Comparative\_advantage [↑](#footnote-ref-1)
2. http://en.wikipedia.org/wiki/Opportunity\_cost [↑](#footnote-ref-2)
3. http://econweb.tamu.edu/aglass/econ452/Krugman03Slides.pdf [↑](#footnote-ref-3)
4. http://www.fores.come/sites/objectivist/2012/09/06/the-virtue-of-eemployee-layoffs/ [↑](#footnote-ref-4)
5. http://blog.gthankyou.com/2013/02/07/research-shows-happy-employees-are-more-productive-by-gthankyou/ [↑](#footnote-ref-5)
6. http://blog.kissmetrics.com/googles-culture-of-success/ [↑](#footnote-ref-6)