Problem 2 – Workforce Planning

A software company is anticipating increased demand for its products. However, management is concerned about their programmers' adequacy to meet the increased demand given the history of workforce turnover (5 percent of the programmers leave the company at the end of each month).

Rather than hiring new workers, management is contemplating enrolling some or all of their programmers in a month-long intensive training program. After successfully completing the training program, a programmer would receive a salary increase and sign a contract not to leave the company for at least 6 months. Successfully trained programmers would therefore be immune from normal turnover and lay-offs.

Management believes that successful completion of the program would increase a programmer's productivity by 20 percent and plans to implement a no-lay-off policy to encourage participation. However, only 90 percent of the programmers are predicted to complete the training program successfully. Those who enroll in training but do not complete the program successfully will return to the workforce at their pre-training skill level. (For simplicity, we assume that they are not candidates for a normal turnover during their training month but are candidates for normal turnover after the training month, and that they can enroll in the training program again later.)

*The monthly demand for untrained programmers for the next six months is shown in the table below. If trained programmers are available, their higher productivity allows management to satisfy demand with fewer programmers. For example, the demand in January can be satisfied with 100 untrained programmers, or with 82 untrained and 15 trained programmers (since 82+1.20*15=100).*

	Number of untrained programmers required					
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Programmers	100	100	115	125	140	150

A programmer cannot be engaged in production and participate in the training during the same month. At the beginning of January, there are 145 (untrained) programmers in the workforce. The company's monthly payroll costs are $3000 per untrained programmer (engaged in either production or training program) and $3300 per trained programmer.

Questions:

*(a) Determine a training schedule and a lay-off schedule for January through June that meets the workforce requirements at the minimum cost. What is the optimal cost? (**Define decision variables as continuous variables.**)*

*(b) If the company could shift demand from June to April (i.e., June demand=125 and April demand =150), determine the optimal training schedule and a lay-off schedule. Would the cost be higher or lower, and by how much? (**Define decision variables as continuous variables.**)*

Assumptions:

*(1) **Lay-offs**:*

a. A lay-off is a decision that the company makes. People who are laid-off by the company will not return to the company in the next six months.

b. Lay-off decisions are made by the company at the beginning of each month, simultaneously as the training decisions are made.

c. People who get laid-off at the beginning of the month will leave the system at the beginning of the month and will not receive a salary in that month.

(2) ***Turnovers****:*

a. Turnover means employees leave the company voluntarily for various reasons (e.g., they might be pursuing better opportunities elsewhere).

b. Each month, after laying off some untrained employees and sending some untrained employees to the training program, the company has the remaining untrained employees and trained employees work in production. Those remaining untrained employees will have a 5% turnover at the end of the month; they will receive a salary for that month because they leave at the end of the month.