

# Quality Based Software Project Staffing and Scheduling with Budget and Deadline

Dongwon Seo\*, Donghwan Shin\*, Doo-Hwan Bae\*

\*School of Computing, Korea Advanced Institute of Science and Technology, Korea

Email: {dwseo, donghwan, bae}@se.kaist.ac.kr

**Abstract**—Software project planning is becoming more complicated and important as the size of software project grows. Many approaches have been proposed to help project managers by providing optimal staffing and scheduling in terms of minimizing the salary cost or duration. Unfortunately, the software quality, another critical factor in software project planning, is largely overlooked in previous work. In this paper, we propose the quality based software project staffing and scheduling approach. We provide better software project plans considering quality with either cost bound (Budget) or duration bound (Deadline) for software project managers.

## I. INTRODUCTION

Since ineffective software project scheduling can lead the failure of software project [1], it is significant for project managers to schedule the project thoroughly. In software project scheduling, staffing is most important work because software development is people intensive activity.

Given tasks for a software project and human resources, there are many cases of staffing. Many studies have proposed automatic staffing approaches for scheduling and they aim to minimize salary cost or duration [2]. However, considering salary cost or duration only would lead ineffective software project scheduling because it overlooks relationship between the employee and tasks.

In this paper, we consider the employee, the task, and cost or duration together with the aid of GA (Genetic Algorithm) search. We define the relationship between the employee and the tasks as the quality score of software product in terms of software defects. We search the scheduling by the fitness function which considers quality score with either cost or duration as a bound.

## II. QUALITY BASED SOFTWARE PROJECT PLANNING APPROACH

Software project planning using genetic algorithm is composed of the three steps: (1) assign proper employees to tasks (i.e., staffing), (2) calculate the schedule from the staffing result (i.e., scheduling), and (3) search for better plans by evaluating the current plan. (i.e., evaluation). In staffing step, employees are assigned to task and, their working hours on the time unit are decided. To generate various staffing results, we use operation of genetic algorithm (i. e., mutation, crossover, selection). Using the staffing result, scheduling is performed. It decides when each task starts and ends. After scheduling is completed, the scheduling result is evaluated. By defining the cost or duration bound in the fitness function, we get the plan result which satisfying the cost or duration bound, and maximizing quality score.

### A. Quality Score

A quality score represents possibility of generating the defect. It is in range from 0 to 1. If the quality score is high, then it means that the software product of the plan has more defect than plan of lower quality score. There are three steps for calculating a quality score as follows.

1) *Quality score on the task level*: We calculate quality score on the task level ( $QT$ ) using practical considerations which related to the number of multitasking tasks, the continuity of tasks, and the number of allocated experts [3].

2) *Quality score on the phase level*: we calculate the quality score on the phase level ( $QP$ ) by aggregating  $QT$ . When aggregating the  $QT$  values of the tasks in a phase, we use task *Severity*. Severity means the vulnerability to defects.

3) *Quality score on project level*: we calculate the quality score on the phase level ( $QS$ ) by aggregating  $QP$ . When aggregating the  $QT$  values of the tasks in a phase, we use the weight of each phase.

### B. Fitness function

$$Fitness\ score = \begin{cases} w_q \times QS + w_c || d \times \frac{(cost || duration)\ bound}{cost || duration} \\ ((cost || duration) > (cost || duration)\ bound) \\ w_q \times QS + w_c || d \times 1 \\ ((cost || duration) \leq (cost || duration)\ bound) \end{cases} \quad (1)$$

## III. CONCLUSION

We propose the automatic software project planning approach considering the quality of the software product with either the required cost or duration. Our approach provide software project plans that considers software quality satisfying either the cost bound as called budget or duration bound as called deadline by the project manager.

## REFERENCES

- [1] H. R. Kerzner *et al.*, *Project Management-Best Practices: Achieving Global Excellence*. John Wiley & Sons, 2010, vol. 14.
- [2] D. C. Peixoto, G. R. Mateus, and R. F. Resende, "The issues of solving staffing and scheduling problems in software development projects," in *Computer Software and Applications Conference (COMPSAC), 2014 IEEE 38th Annual*. IEEE, 2014, pp. 1–10.
- [3] J. Park, D. Seo, G. Hong, D. Shin, J. Hwa, and D.-H. Bae, "Human resource allocation in software project with practical considerations," *International Journal of Software Engineering and Knowledge Engineering*, vol. 25, no. 01, pp. 5–26, 2015.