Introduction

Project planning is one of the most important processes in Software Engineering. Project planning provides a framework that helps a project manager to estimate resources (people, time and cost) that are limited. A project plan is updated throughout lifecycles of Software Engineering from the starting point to the end of one software project (Harman et al., 2012a). The project plan depends on the characteristics of program, resources, time schedules, and the order of tasks (Antoniol et al., 2005; Harman et al., 2012a). However, a project manager usually has to face problems in project planning process because resources are limited, each task need specific skills, and some tasks have dependencies. These restrictions affect a project manager to generate a good project plan for one software project (Harman et al., 2012a). These restrictions relate to allocation between tasks and resources.

A problem in project planning is task allocation problem. Task allocation problem occurs when available resources are assigned in unsuitable tasks. In experiences of project planning, it can be hard to find a solution to each of task allocation problem with available resources (i.e., people, cost and time) that are limited (Harman et al., 2012a). We cannot know exactly how many resources are available we have of them and which ones are the best resources for their tasks. For example, a company invests to implement a project. If resources of project planning that are assigned in tasks are not suitable, then the project may not be delivered on time. This problem impacts the use of resources and is a costly investment. This problem also affects reliability and the public image of the company. In addition, when deadlines are made longer or deadlines are not met on time, this also increase costs (Gueorguiev et al., 2009). A project manager needs to make carefully decisions to assign all available resources to each task from the beginning to the end in order to avoid task allocation problem because such problem can occur when available resources are assigned to unsuitable tasks (Chang et al., 2001). Therefore, task allocation problem is a critical problem in project planning that impacts the waste of performance, cost and time of the product. This is the important reason why project planning problem should be solved.

Search-Based Software Engineering (SBSE) uses Search-Based techniques to solve problems in software engineering problems. Search-Based technique is a technique that seeks optimal

solutions or near optimal solutions to their problems (Harman and Jones, 2001). Search-Based Software Engineering has been applied to problems in Software Engineering, such as requirements, design, project planning, testing and re-engineering (Harman et al., 2012a). This project focuses on task allocation problem in a project plan. Search-Based Software Engineering is one of many approaches to solve project planning problem. Search-Based Software Engineering has been used to task allocation problem to find an optimal project plan of this problem. The optimal project plan that has proper task allocation is an approach to evaluate the performance of the software product (Chang et al., 2001). For proper task allocation, available resources are assigned suitably into tasks, where each task has a duration, some dependencies and requires specific skills. Therefore, finding the optimal project plan requires good project management to allocate available resources with suitable tasks for a good performance of the product.

A Genetic Algorithm (GA) is one of the popular search techniques of Search-Based Software Engineering for solving optimization problems that are based on natural selection (Bhatia, 2017). Genetic Algorithm which is a search technique can be used to address task allocation problem (Vega-Velázquez et al., 2018). Genetic Algorithms can solve huge problems quickly, effectively and reliably (Sastry et al., 2014). Genetic Algorithms rely on the population in the type of string to find the optimal solutions to their problems (Sastry et al., 2014). Genetic Algorithms have been used in solving task allocation problem in project planning process to maximize the performance (Antoniol et al., 2004; Leus and Herroelen, 2004). In this project, Genetic Algorithms will be used to find the optimal project plan, taking into account robustness. Robustness of a project plan means that a product can be delivered on time with good performance, even though resources or tasks may change during the project (Harman et al., 2012b). A robust project plan considers the performance of the suitable allocation of resources to tasks, avoiding potential problems.

The purpose of this project will focus on finding the optimal project plan or near optimal project plan to task allocation problem of project planning using Genetic Algorithms. There are two main approaches: to find robustness of project planning and to minimize the project duration. For finding robustness in project planning, the project will compare the performance between Genetic Algorithms and the (1+1) Evolutionary Algorithms.

Antoniol, G., Di Penta, M., Harman, M., 2005. Search-based techniques applied to optimization of project planning for a massive maintenance project. IEEE, pp. 240–249.
Antoniol, G., Di Penta, M., Harman, M., 2004. Search-Based Techniques for Optimizing Software Project Resource Allocation, in: Deb, K. (Ed.), Genetic and Evolutionary Computation – GECCO 2004. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 1425–1426.
Bhatia, R.P.K., 2017. Application of Genetic Algorithm in Software Engineering : A Review. Int. Refereed J. Eng. Sci. 6, 63–69.
Chang, C.K., Tao, Z., Mark, C., 2001. Genetic Algorithms for Project Management 33.
Gueorguiev, S., Harman, M., Antoniol, G., 2009. Software project planning for robustness and completion time in the presence of uncertainty using multi objective search based software engineering. ACM Press, p. 1673.
Harman, M., Jones, B.F., 2001. Search-based software engineering. Inf. Softw. Technol. 7.
Harman, M., Mansouri, S.A., Zhang, Y., 2012a. Search-based software engineering: Trends, techniques and applications. ACM Comput. Surv. 45, 1–61.
Harman, M., McMinn, P., de Souza, J.T., Yoo, S., 2012b. Search Based Software Engineering: Techniques, Taxonomy, Tutorial, in: Meyer, B., Nordio, M. (Eds.), Empirical Software Engineering and Verification. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 1–59.
Leus, R., Herroelen, W., 2004. Stability and resource allocation in project planning. IIE Trans. 36, 667–682.
Sastry, K., Goldberg, D.E., Kendall, G., 2014. Genetic Algorithms, in: Burke, E.K., Kendall, G. (Eds.), Search Methodologies. Springer US, Boston, MA, pp. 93–117.
Vega-Velázquez, M.Á., García-Nájera, A., Cervantes, H., 2018. A survey on the Software Project Scheduling Problem. Int. J. Prod. Econ. 202, 145–161.