Abstract

In recent trends, sea borne transportation plays an important role in bulk material handling transportation and influences the economic growth of the country. The UNCTAD (2015) describes the growth of sea-borne trade by 4.4 % and total goods loaded about 9.6 billion tons in the world. Ports are one of the key components of a nation's marine transportation system. The task of making the port efficient both economically and operationally forms a significant problem for the port management. The dry bulk material such as various grades of coal, iron-ore are imported to or exported from the bulk facility. Essentially, these materials are received, stored, processed and dispatched using port machinery such as a loader/unloader, conveyor, stacker, reclaimer etc. and port acts as a buffer between incoming and outgoing vessel traffic. The operation in dry bulk material handling port can be classified into three major operations: sea side operations, yard operations and inland transportation. Sea side operations usually begin with the arrival of the ship in the port area and depending on the system congestion, the ship may or may not have to wait in the anchorage area. A tugboat is assigned to guide the ship to the berth through the channel. After berthing, the crane/ship-unloader operation begins to unload cargo. When unloading is finished, a pilot tugboat is assigned to guide the ship which leaves the berth. One of the main concerns of port management is the departure of the ship from the port as soon as possible and minimize the service time of berthed ships. The major steps needed to obtain the efficient port operations requires ship sequencing with respect to available berth allocation, ship unloader allocation and rake allocation to fulfill the customer demand. The objective of the thesis is to classify on the basis of major bulk material handling port operations i.e. sea side operations, yard side operations and land side operations. In each objective, a mathematical model is developed to address the port operations and used a metaheuristic method to solve the objectives for different scenarios. The ultimate goal of task for all objectives is to (i)

minimizing the waiting time and the deviation of customer priority (ii) minimizing the operational time of the ship and allocate the ship unloader to berth ship in optimal manner. (iii) minimizing the waiting time of rake service respectively. As sojourn time of ship at port causes a huge loss in the form of demurrage cost to the ship owner and customer, and given the scale and complexity of the problem, three mathematical models for different scenario are proposed and solved.

Keywords: Ship sequencing; Berth allocation problem; Ship unloader allocation; Rake scheduling; Meta-heuristic algorithm