Task Assignment for Software Development Project by Assignment Method

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Abstract—Software development department has responsibility in manage the optimization of software project development cost. Normally, the software department has a group of programmers whom has a difference competency and hire cost per hour. This experimental research choose Assignment method for solving about task allocation of particular programmer on the same starting time of software development projects. This method can provide the optimal development cost in defined development time of both programmer available time and software project required time.

Keyword: assignment method, software development task assignment

I. INTRODUCTION

Software development task allocation based on programmer limitation of working hours. This paper aim to solve the problem of task allocation of department programmers on the same starting time software developments project.

There are many programmers with difference computer competency therefore each programmer has a difference payment of his working hour according to his experience. Normally, each software department has many software projects that are simultaneous implementation.

The problem of software department has to consider the optimal point in programmers' allocation for each software development project in order to keep the minimum cost of software development project.

II. RELATED THEORY

A.Assignment method

There are many assignment method that could find out the minimization or maximization of objective function. Linear programming and nonlinear programming are the popular technique. The problem of LP and NLP is that the result of optimization is not an integer number. Therefore, another technique, such as integer programming and transportation or assignment method, are alternation method that are used to solve for the optimal value of objective. Nevertheless, the result of integer programming give the less precise result than LP and NLP.

1.Northwest corner method: NC [1]

The northwest corner method is the technique that consider allocate the amount of item to the most north-west cell of task assignment table. Then, the amount of item will be allocated to the adjacent cell which has the minimum value of optimization target variable. Every allocation must consider on maximum amount of each row and column.

2.The minimum cell cost method: MC [2]

This method will firstly allocate amount of item to the cell that has a minimum value of optimization target variable. The next allocation cell will choose on the cell that located in the same row or column of the previous allocated cell and having the minimum value of optimization target variable.

3.Vogel's approximation method: VAM [3]

TVAM method consider to allocate the amount of item to the cell from the row that has the largest value of penalty cost. The assigned cell, from select row, will choose from the minimum value of optimization target variable cell.

B. Assignment Problem using Branch and Bound [4]

Branch and Bound technique is used to find out the minimal cost function by assign amount of item to the cell in table by consider on two conditions. There are two views of assignments. The first is aim to the worker. Worker will be assigned to the unassigned task which has minimum cost. The second condition is consider on the task. The worker which has the lowest cost will be first chosen. There are many task assignation until all limitation of demand and supply are met.

III. RESEARCH METHODOLOGY

This research is conduct on a private sector of software development. The research is applied on the 2020 fiscal year. This department has three programmer staff. The available time of each programmer is present in table 1.

A.Data collection

Table I. Available hour for working of each programmer

Developer	Available time (hour)-(AT)
D1	105
D2	120
D3	75

There are three assigned software project that have to implement and finish in the 2020. The estimation of software development time of each project are present in table 2.

Table II. Require hours for each software development project

S/W project	Required hours(RH)
P1	110
P2	100
P3	90

Since each programmer has a difference computer competency then the hire cost per hour of them are not in the same hire rate as shown in table 3.

Table III. Hire cost of developer for software development project

Hire per hour(THB)	P1	P2	P3
D1	100	140	180
D2	150	80	75
D3	90	110	130

The summary of demand of programmer and project supply are shown in table 4.

For example, the partial ROW 1 AND COLUM 1,

From/To	P1
	100
D1	d1p1

Where,

D1 is the programmer or developer #1,

P1 is the software project #1.

"100" is the hire of D1 on P1.

d1p1 is the amount of item or hour of work of d1 allocate on p1.

"105" is the total available working hour of d1.

"110" is the total require hour of working of p1.

Table IV. Assignment path table

From/To	P1	P2	P3	AT
	100	140	180	
D1	d1p1	d1p2	d1p3	105
	150	80	75	
D2	d2p1	d2p2	d2p3	120
	90	110	130	
D3	d3p1	d3p2	d3p3	75
RH	110	100	90	300

B.Minimization objective

The objective of the experiment is to completely finish all software project under the minimal software development cost, as shown in equation 1.

$$MinmizeZ = 100d1p1 + 140d1p2 + 180d1p3$$
$$+150d2p1 + 80d2p2 + 75d2p3$$
$$+90d3p1 + 110d3p2 + 130d3p3$$
$$subject\ \ to$$
$$d1p1 + d1p2 + d1p3 = 105$$
$$d2p1 + d2p2 + d2p3 = 120$$
$$d3p1 + d3p2 + d3p3 = 75$$
$$d1p1 + d2p1 + d3p1 = 110$$
$$d1p1 + d2p1 + d3p1 = 110$$
$$d1p3 + d2p3 + d3p3 = 90 \quad (1)$$

Where Z is the total hire of all programmers whom are assigned to the software development projects.

For example, d1p1 is the amount of working hour of programmer " d1" which is assigned on software project "p1".

C.Results of three assignment methods

Three assignment methods are applied to the sample data to find out the minimal of software development cost.

The result of each method must show the most optimal software development cost and the amount working hour of each programmer to suitable software projects.

The calculation result of NC, MC and VAM method are presented in table V, VI and VII as following shown.

1.NC Method

The path of NC assignment method are d1p1->d2p1->d2p2->d2p3->d3p3.

The total cost (Z) is d1P1*100+d2p1*150+d2p2*80+d2p3*75+d3p3*130.

Z = 105*100+5*150+100*80+15*75+75*130

= 30,125 THB

Table V. The cost minimization assignment result of NC

From/To	P1	P2	P3	AT
	100	140	180	
D1	105	0	0	105
	150	80	75	
D2	5	100	15	120
	90	110	130	
D3	0	0	75	75
RH	110	100	90	300
cost	**30,125**			

2.MC Method

The path of MC assignment method are d2p3->d2p2->d3p2->d3p1->d1p1.

The total cost (Z) is d2p3*75+d2p2*80+d3p2*110+d3p1*90+d1p1*100.

Z= 90*75+30*80+70*110+5*90+105*100

=27,800 THB

Table VI. The cost minimization assignment result of MC

From/To	P1	P2	P3	AT
	100	140	180	
D1	105	0	0	105
	150	80	75	
D2	0	30	90	120
	90	110	130	
D3	5	70	0	75
RH	110	100	90	300
cost	**27,800**			

3.VAM Method

The path of VAM assignment method are d1p1->d2p1->d2p3->d2p2->d3p2.

The total cost (z) is d1p1*100+d2p1*150+d2p3*75+d2p2*80+d3p2*110.

Z = 105*100+5*150+90*75+25*80+75*110

= 28,250 THB

Table VII The cost minimization assignment result of VAM

From/To	P1	P2	P3	AT	Penalty -1	Penalty -2
	100	140	180		40	
D1	105	0	0	105		
	150	80	75		5	75
D2	5	25	90	120		
	90	110	130		20	40
D3	0	75	0	75		
RH	110	100	90	300		
cost	**28,250**					

IV. SUMMARY AND SUGGESTION

The result of software cost estimation of three assignment methods present that NC, MC and VAM are 30,125, 27,800 and 28,250 THB respectively.

Therefore the MC method could give the assignment solution that has the minimal software development project cost, 27,800 THB.

The developer D1 is assigned his whole working hour 105 hours for project P1.

The developer D2 is assigned his working hour 30 hours, 90 hours for project P2, P3 respectively.

The developer D3 is assigned his working hour 5 hours, 70 hours for project P1, P2 respectively.

Since, there are many empty cell such as d2p1, d1p2, d1p3 and d3p3 as shown in table VI.

Further calculation, these empty cell could be consider to reduce or increase the amount of assigned item for the prior result of MC method. The minimal cost could be scrutiny examine by stepping stone technique [5] in order to reach the best optimal point of the minimization function.

V. REFERENCE

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