CHAPTER 3

PBUC USING MEMORY MANAGEMENT ALGORTHM

3.1 INTRODUCTION

Memory management is the process by which a computer allocates a limited amount of physical memory, among the various processes that need it, in a way that optimizes performance.

In an environment that supports dynamic memory allocation, the memory manager must keep a record of the usage of each allocatable block of memory. This record could be kept by using almost any data structure that implements linked lists. An obvious implementation is to define a free list of block descriptors, with each descriptor containing a pointer to the next descriptor, a pointer to the block, and the length of the block. A number of strategies are used to allocate space to the processes that are competing for memory. The real challenge of efficiently managing memory is seen in the case of a system which has multiple processes running at the same time. Since primary memory can be space-multiplexed, the memory manager can allocate a portion of primary memory to each process for its own use. However, the memory manager must keep track of which processes are running in which memory locations, and it must also determine how to allocate and deal locate available memory when new processes are created and when old processes complete execution. While various different strategies are used to allocate space to processes competing for memory, three of the most popular are best fit, Worst fit, and first fit.

3.1.1. Basic Terms Used in MMA

Initially, all memory is available for user processes, and it considers the available block of memory, a hole. When a process arrives and needs memory, we search for a whole large enough for the process. If we find one, we allocate only as much memory as is needed, keeping the rest available to satisfy the future request.

The set of holes is searched by the allocator to determine which hole is the best for the purpose of allocation. The following strategies are used for the selection of a free hole from the set of available holes.

3.1.1.1 First Fit

In the first fit algorithm, the allocator keeps a list of free blocks and on receiving a request for memory, scans along the list for the first block that is large enough to satisfy the request. If the chosen block is significantly larger than that requested, then it is usually split, and the remainder added to the list as another free block.

3.1.1.2 Best Fit

The allocation policy always allocates from the smallest suitable free block. The allocator searches the entire list, unless the list is ordered by size. Suitable allocation mechanisms include sequential fit searching for a perfect fit, first fit on a size-ordered free block chain, segregated fits, and indexed fits. Many good fit allocators are also described as best fit. This strategy produces the smallest leftover hole.

3.1.1.3 Worst Fit

The allocation of the largest hole takes place in worst fit allocation technique. Again, the allocator searches the entire list, unless it is sorted by size. This strategy produces the largest leftover hole, which may be more useful than the smaller leftover hole from a best-fit approach.

3.1.2 Algorithm

Step 1 : Declare the required variables.

Step 2 : Get the memory partition size and page size from the user.

Step 3 : Select the algorithm based on the choice from the user using switch case.

Step 4 : For the First Fit Algorithm, find the first memory partition which is big enough to hold that process and allocate the memory partition to that process. Also calculate the free memory space.

Step 5 : For the Best Fit Algorithm, find the smallest memory partition which is big enough to hold the requesting process and allocate the memory partition to the process and calculate the free memory space.

Step 6 : For the Worst Fit Algorithm, find the largest available memory partition which is big enough to hold the requesting process and allocate the memory partition to the process and calculate the free memory space.

Step 7 : Display the final frame size and allocated process details and free memory space.

Step 8 : Terminate the program

3.2 APPLICATIONS OF MMA IN PBUC

The Memory Management Modules of an operating system are concerned with the management of primary memory. Primary memory means the processors from which instructions and data can be directly accessed. Memory management is concerned with four functions specifically;

- Keeping track of the status of each location of primary memory
- Determining allocation policy for memory
- Allocation technique - once it is decided to allocate memory, the specified location must be selected and allocation information will be updated.
- Reallocation technique and policy.

In general, a set of holes of various sizes is scattered throughout memory at any given time. When a process arrives and needs memory, the system searches this set for a hole that is large enough for the process. In PBUC, memory present in the system is equated to the maximum capacity of generator units and the process is equated to the forecasted demand.

Best Fit allocates forecasted demand from smaller capacity of available generator by satisfying the constraints mentioned in (2.5) to (2.11) where in Worst Fit allocates forecasted demand from higher capacity of given generator units. MMA uses Best Fit Allocation and Worst Fit Allocation for allocating Forecasted Demand which is implemented in Java, a web based

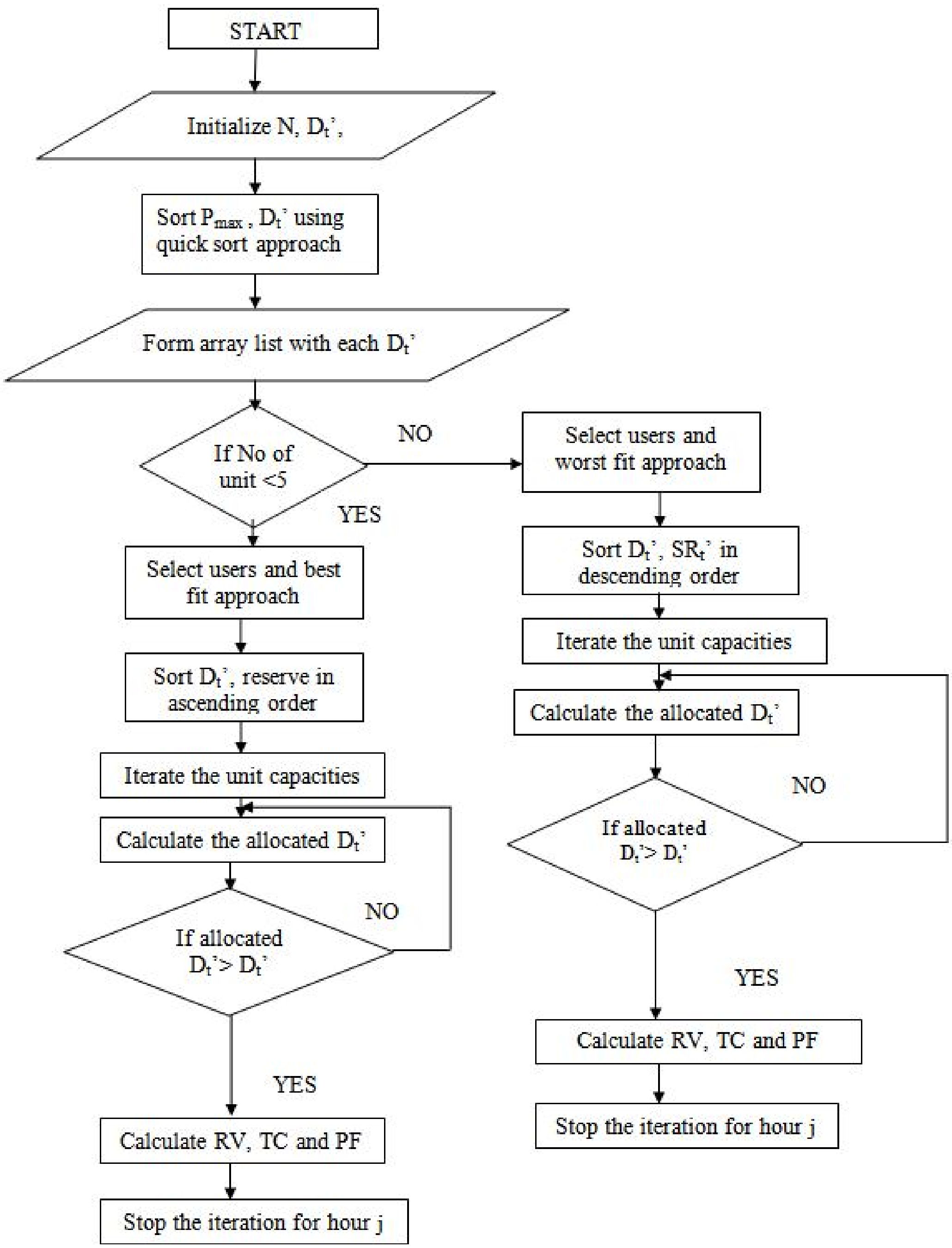

Figure 3.1 Flow chart of MMA method

applications. Best Fit allocation works well for 2 and 3 unit system rather than worst Fit allocation, since Best Fit allocate forecasted demand from smaller capacity of the generator. But for 10 unit system, MMA dynamically chooses the Worst Fit Algorithm, so that less number of generators are in ON condition. If Best Fit is selected, the more number of generators are in ON condition, then total cost of the system will be more. Worst fit allocate forecasted demand from the higher capacity of the generator to maximize profit for large scale system. So the number of generator randomly considered as 5 for the selection of allocation type. If the number of generators is greater than 5, then profit is high for Worst Fit Algorithm rather than for Best Fit Algorithm.

3.3 IMPLEMENTATION

The MMA method has been implemented in Java and tested using three different systems to solve PBUC problem. MMA chooses the best fit allocation if the number of generator is less than five. Before running PBUC-MMA, the Gencos need to get an accurate hourly demand and price forecast for the scheduling period. Fuel cost function of each generator is estimated in to quadratic form. Simulations are carried out to find optimal solution, solution time, and profit without the effect of probability that reserve is called and generated for 2 unit system and they are also compared with existing methods. The MMA method considers the effect of probability that reserve is called and generated for 3 and10 unit system. The forecasted demand, forecasted prices and fuel cost data of 2, 3 and 10 unit system are listed in Appendix. Based on the forecasted information, power is dispatched economically by the MMA method. In PBUC, Gencos no longer have the obligation to meet the demand. Gencos may choose to generate less than the demand.

Table 3.1 Optimum allocation of generation of 2 generator case

Hr	U1 (MW)	U2 (MW)	RV(Rs)	TC(Rs)	PROFIT(Rs)
1	180	105	442377	148717	293659
2	180	113	405394	152695	252698
3	180	87	311909	139764	172143
4	180	0	201528	93009.6	108518
5	180	115	378420	153690	224734
6	180	112	218299	152198	66100.2
7	180	119	163612	155679	7932.6
8	180	148	174758	170102	4775.4
9	180	146	178387	169108	9278.4
10	180	118	158774	155182	3591.6
11	180	87	404184	139765	264417
12	180	113	464991	15295.8	312294
13	180	170	525000	181044	343954
14	180	170	504000	181044	322950

Table 3.2 Comparison of the results of 2 unit system with existing method GA

Hour	PBUC-GA method (Profit(Rs)), (Richter and Sheble 2000)	MMA (Profit (Rs))
10	147063	**1143432**
12	294661	**1720124**

In two generator case, the effect of the probability of reserve and forecasted reserve are not considered. Table 3.1 shows the scheduling of power for 14 hours without reserve. Profit at 13th hour is high, even when power scheduled at the 13th and the 14th hours are the same since the spot price varies on an hourly basis. From Table 3.2, it is observed that the proposed approach obtains 5 to 7 times higher profit than PBUC-GA (Richter and Sheble 2000). Next, the performance has been studied for 3 generator 12 hour test data. Table 3.3 shows example of power and reserve scheduling plans for reserve payment method A. In method A, reserve is paid only when the reserve power is actually delivered and used. Profit is more sensitive when r is varied. Table 3.4 shows example of power and reserve scheduling plans for reserve payment method B. In method B, reserve is paid for all the time even when reserve is not delivered. Here profit is more sensitive when reserve price is varied. From Table 3.5 and 3.6, it is clear that MMA with best fit allocation provides maximum profit compared to the existing methods, for method A and B respectively.

Table 3.3 Power and reserve generation of reserve payment method A(r=.005, reserve price = 3* spot price)

Hr	PBUC by MMA (A)						Profit ($)	Profit (Rs)
	Power (MW)			Reserve (MW)				
	U1	U2	U3	U1	U2	U3		
1	0	0	170	0	0	20	531.1	31866.0
2	0	0	200	0	0	0	572.6	34356.0
3	0	0	200	0	0	0	303	18180.0
4	0	320	200	0	55	0	301.79	18107.4
5	0	400	200	0	0	0	600	36000.0
6	0	400	200	0	0	0	1350	81000.0
7	0	400	200	0	0	0	1380	82800.0
8	0	400	200	0	0	0	990	59400.0
9	0	400	200	0	0	0	810	48600.0
10	0	0	200	0	0	0	740	44400.0
11	0	0	200	0	0	0	650	39000.0
12	0	350	200	0	0	0	923.75	55425.0
					TOTAL		**9146.64**	**548798.4**

Table 3.4 Power and reserve generation of reserve payment method B(r=.005, reserve price =.04 x spot price)

Hr	PBUC by MMA (B)						Profit ($)	Profit (Rs)
	Power (MW)			Reserve (MW)				
	U1	U2	U3	U1	U2	U3		
1	0	0	170	0	0	20	537.5	32250.0
2	0	0	200	0	0	0	570	34200.0
3	0	0	200	0	0	0	300	18000.0
4	0	320	200	0	55	0	317.08	19024.8
5	0	400	200	0	0	0	600	36000.0
6	0	400	200	0	0	0	1350	81000.0
7	0	400	200	0	0	0	1380	82800.0
8	0	400	200	0	0	0	990	59400.0
9	0	400	200	0	0	0	810	48600.0
10	0	0	200	0	0	0	740	44400.0
11	0	0	200	0	0	0	650	39000.0
12	0	350	200	0	0	0	923.75	55425.0
TOTAL							**9168.18**	**550090.8**

Table 3.5 Comparison of the results of 3 unit system with existing methods by MMA method (Method –A)

S.no	Method	Profit (Rs)
1	PBUC by LR-EP method (Attaviriyanupap et al 2003)	544458
2	PBUC by Muller method (Chandram and Subrahmanyam 2008)	541830
3	PBUC by LR-ACSA method (Bavafa et al 2008)	544866
4	**MMA method**	**548798.4**

Table 3.6 Comparison of the results of 3 unit system with existing methods by MMA method (Method –B)

S.no	Method	Profit (Rs)
1	PBUC by LR-EP method (Attaviriyanupap et al 2003)	548160
2	**MMA method**	**550090.2**

A ten unit 24 – period system is used to show that the MMA with worst fit allocation can work well with larger system to dispatch power economically. Worst fit allocates forecasted demand from the higher capacity of the generator. Based on the forecasted information, power is dispatched economically with the effect of 'r' by the proposed method and it is shown in Tables 3.7 and 3.8. From Table 3.9, it is clear that the proposed method provides maximum profit for method A compared to the existing methods of PBUC by LR-EP method (Attaviriyanupap et al 2003), Muller method (Chandram and Subrahmanyam 2008), MAS (Jing Yu et al 2004), TS –RP (Victorie and Jeyakumar 2005), TS – IRP (Victorie and Jeyakumar 2005) and improved PSO (Yuan Xiaohui et al 2005). For method B, the profit obtained by LR-EP method (Attaviriyanupap et al 2003) is compared with the proposed method as shown in Table 3.10.

Table 3.7 Power and reserve generation of reserve payment method A (10 Units system) (r=0.05, reserve price =5 * spot price)

Hr	Profit based unit commitment(Reserve payment method A)																					
	Power(MW)										Reserve(MW)										Profit ($)	Profit (Rs)
	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10		
1	0	455	0	83	162	0	0	0	0	0	0	0	0	47	0	0	0	0	0	0	1380.86	82851.6
2	295	455	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	1830.45	109827.0
3	395	455	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	3302.38	198142.8
4	455	455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3258.2	195492.0
5	455	455	0	0	90	0	0	0	0	0	0	0	0	0	72	0	0	0	0	0	3673.89	220433.4
6	455	455	0	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5475.5	328530.0
7	455	455	0	0	162	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	2130.25	127815.0
8	455	455	0	128	162	0	0	0	0	0	0	0	118	2	0	0	0	0	0	0	2701.02	162061.2
9	455	455	0	130	162	0	85	0	0	0	0	0	130	0	0	0	0	0	0	0	5443.45	326607.0
10	455	455	130	130	162	68	0	0	0	0	0	0	0	0	0	12	85	0	0	0	12374.33	742459.8
11	455	455	130	130	162	33	0	0	0	0	0	0	0	0	0	47	85	0	0	0	12968.66	778119.6
12	455	455	130	130	162	80	85	0	0	0	0	0	0	0	0	0	0	55	55	0	15519.19	931151.4
13	455	455	130	130	162	0	68	0	0	0	0	0	0	0	0	80	17	0	0	0	5262.33	315739.8
14	455	455	0	130	162	0	85	0	0	0	0	0	130	0	0	0	0	0	0	0	8539.10	512346.0

15	455	455	0	128	162	0	0	0	0	0	0	0	118	2	0	0	0	0	0	0	3124.78	187486.8
16	455	455	0	0	140	0	0	0	0	0	0	0	0	0	22	80	0	0	0	0	2821.72	169303.2
17	455	455	0	0	90	0	0	0	0	0	0	0	0	0	72	0	0	0	0	0	2672.07	160324.2
18	455	455	0	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4330.71	259842.6
19	455	455	0	128	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2154.28	129256.8
20	455	455	130	130	162	68	0	0	0	0	0	0	0	0	0	12	85	0	0	0	2977.157	178629.4
21	455	455	0	130	162	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	4049.9	242994.0
22	455	455	0	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5475.51	328530.6
23	445	455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5047.58	302854.8
24	345	455	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0	0	2543.16	152589.6
Total Profit ($)																					**43735.97**	**7144036**

Table 3.8 Power and reserve generation of reserve payment method B (10 Units system) (r = 0.005, Reserve Price = 0.01 * Spot Price)

Hr	Profit based unit commitment(Reserve payment method B)																					
	Power(MW)										Reserve(MW)										Profit ($)	Profit (Rs)
	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10		
1	0	455	0	0	162	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1361.40	81684.0
2	0	455	0	130	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1361.67	81700.2
3	395	455	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	3339.12	200347.2
4	455	455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3258.2	195492.0
5	455	455	0	0	0	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	2936.84	176210.4
6	455	455	0	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6375.51	382530.6
7	455	455	0	0	162	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	2130.25	127815.0
8	455	455	0	128	162	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2654.279	159256.7
9	455	455	0	130	162	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	5383.79	323027.4
10	455	455	130	130	162	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	11758.75	705525.0
11	455	455	130	130	162	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	13027.33	781639.8
12	455	455	130	130	162	80	85	0	0	0	0	0	0	0	0	0	0	0	0	0	15058.466	903507.9
13	455	455	130	130	162	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	5170.507	310230.4

Table 3.8 (Continued)

14	455	455	0	130	162	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	7571.7	454302.0
15	455	455	0	128	162	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3074.28	184456.8
16	455	455	0	0	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2821.35	169281.0
17	455	455	0	0	0	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	2053.094	123185.6
18	455	455	0	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4510.71	270642.6
19	455	455	0	128	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2154.3	129258.0
20	455	455	130	130	162	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	2465.857	147951.4
21	455	455	0	130	162	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	5769.9	346194.0
22	455	455	0	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5475.51	328530.6
23	445	455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5047.58	302854.8
24	0	455	0	130	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	891.52	53491.2
Total Profit ($)																					**115651.9**	**6939114.3**

Table 3.9 Comparison of the results of 10unit system (24Hr) with existing methods by proposed method A

S.no	Method	Profit (Rs)
1	PBUC by LR-EP method (Attaviriyanupap et al 2003)	6769123
2	PBUC by Muller method (Chandram and Subrahmanyam 2008)	6197760
3	PBUC –MAS (Jing Yu et al 2004)	6569112
4	PBUC by TS –RP Victorie and Jeyakumar 2005)	6065160
5	PBUC by TS – IRP Victorie and Jeyakumar 2005)	6195660
6	PBUC by improved PSO (Yuan Xiaohui et al 2005)	6781122
7	**MMA**	**7144036**

Table 3.10 Comparison of the results of 10unit system (24Hr) with existing methods by proposed method B

S.no	Method	Profit (Rs)
1	PBUC by LR-EP method(Attaviriyanupap et al 2003)	6470316
2	**MMA**	**6939114.3**

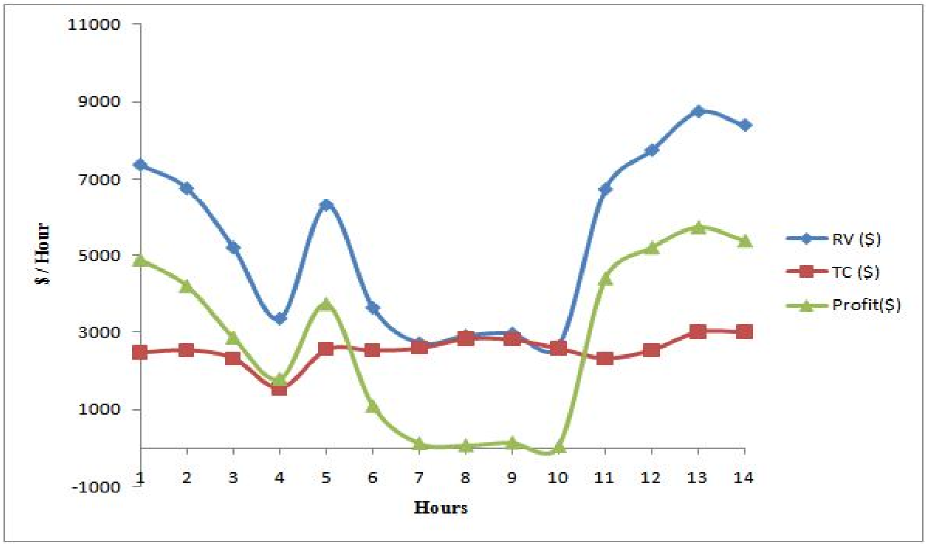

Figure 3.2 Profit, total cost and demand of 2 unit system

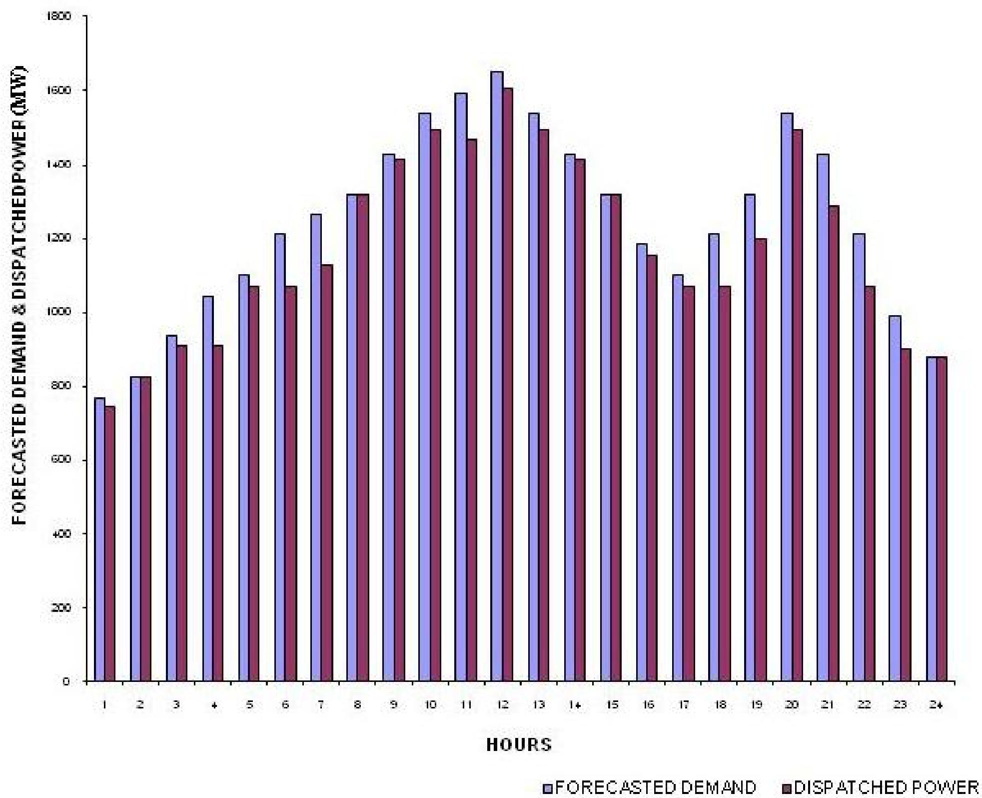

Figure 3.3 Forecasted demand and dispatched power for 24 hour, 10 unit systems (Method A)

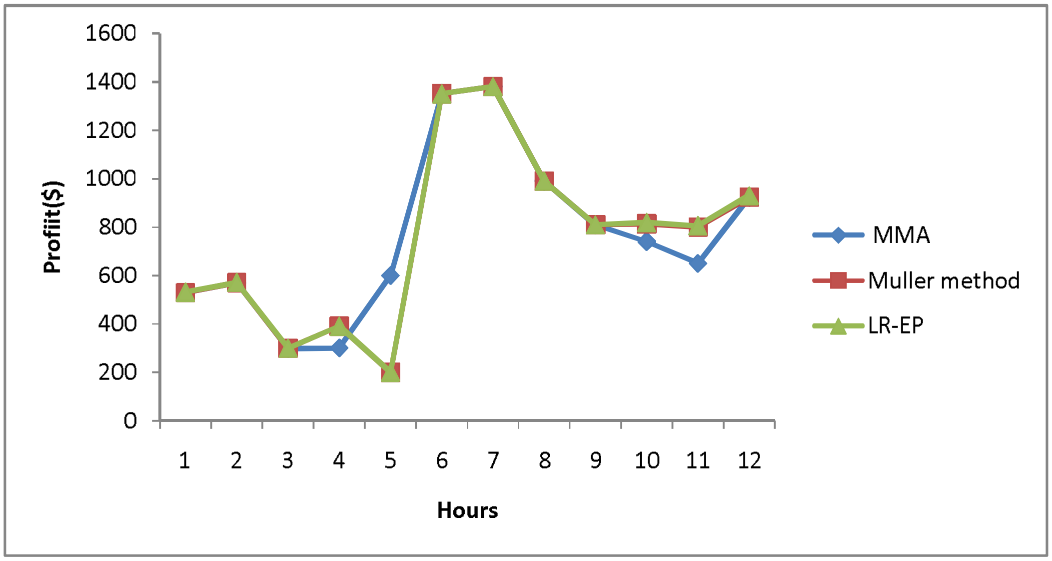

Figure 3.4 Comparison of profit of 3 unit system (method A)

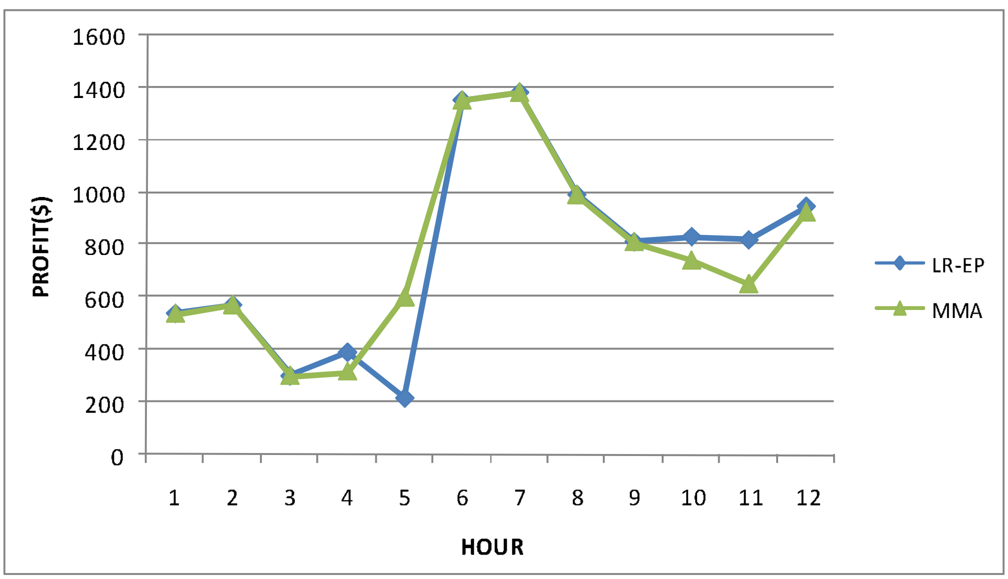

Figure 3.5 Comparison of profit of 3 unit system (method B)

Figure 3.2 shows the variation of revenue, total cost and profit for 14 hours. Since the spot price varies on an hourly basis, profit is found to be higher at the 13th hour. Figure 3.3 shows the allocation of dispatched power for the given forecasted demand for 10 unit system. It is found that dispatched power is less than forecasted demand at all hours to maximize profit. Figures 3.4 and 3.5 show that the proposed method MMA gives maximum profit compared with the existing methods for 3 unit system.

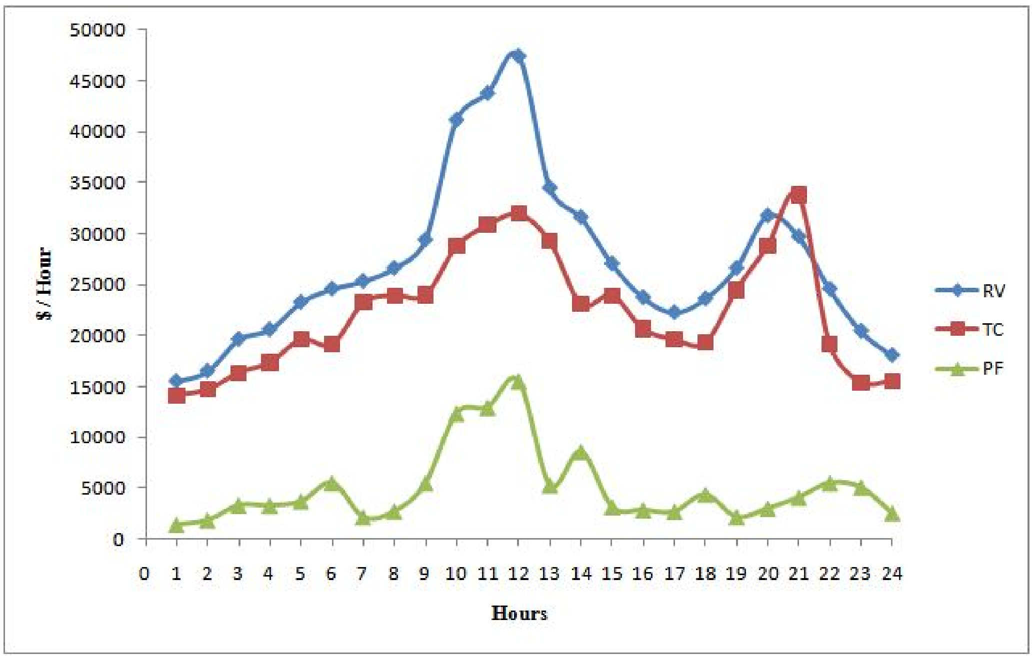

Figure 3.6 Revenue, total cost and profit in dollars for 24 hour, 10 unit systems

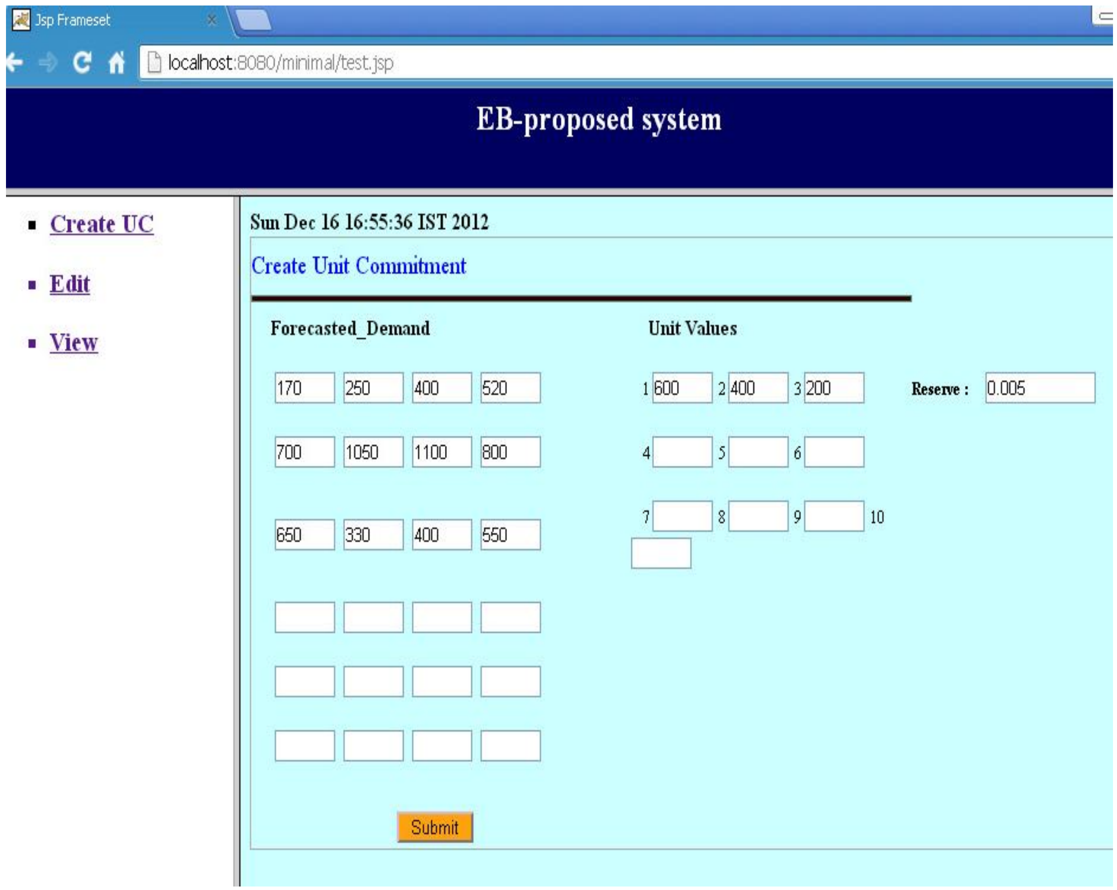

Figure 3.7 Front end in put screen of MMA

MMA developed in Java for web based application can be monitored from anywhere if it could be hosted in the web. Figure 3.7 shows the Front end in put screen of MMA. Figure 3.8 shows the Screen of power Scheduling and corresponding revenue, total cost and profit for 3 unit system.

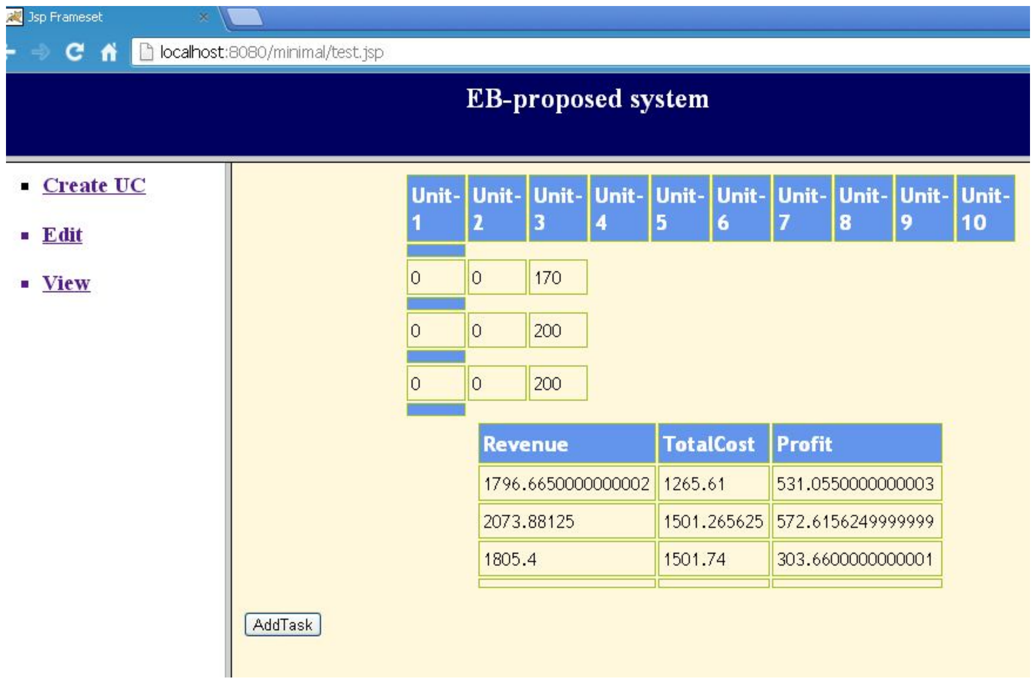

Figure 3.8 Screen of power Scheduling and corresponding revenue, total cost and profit for 3 unit system

3.4 CONCLUSION

A new approach with MMA using Best Fit and Worst Fit allocation has been proposed in this chapter for solving PBUC. Further, it can be implemented for web based application. Based on forecasted demand, PBUC is solved with and without the effect of 'r'. The profit of 2-unit system is 7 and 5 times higher for 10 and 12 hours respectively than PBUC-GA without considering the effect of 'r'. The effect of 'r' and reserve power is considered for 3 and 10 unit system and two reserve payment methods are simulated. All simulated results of 3 and 10 unit system are compared with the results of the existing methods. It is observed that profit obtained by the MMA is higher. In this chapter, MMA is improved to give more accurate solution with less computational time compared to existing methods and is thus amenable for web based operation required in deregulated environment.

But the selection of allocation of algorithm depends on the number of units, in this proposed MMA technique.