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Multi-Level Queue Scheduling based Hospital Management System

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*Abstract* —*. Hospital Management System is a scheduling algorithm-based system which is used to manage patients according to the department. Multilevel Queue Scheduling is used for managing the patients in OPD and Emergency departments.*

***Keywords*** *—multi-level queue, emergency, first come first serve, and priority.*

# INTRODUCTION

Hospital Management System is a multi-level queue scheduling-based system. Multilevel queue scheduling is a popular CPU scheduling algorithm used in operating systems to manage and schedule processes. It divides the processes into multiple queues based on their priority and assigns different priorities to different types of processes. Each queue has its own scheduling algorithm, which is used to determine which process should be given CPU time.

The multilevel queue scheduling algorithm provides a better response time and turnaround time than other scheduling algorithms, especially for systems with many different types of processes with different priorities. Dividing the processes into multiple queues based on their priority ensures that high-priority processes are given priority access to the CPU, thus reducing their waiting time and improving their overall performance.

Overall, the multilevel queue scheduling algorithm is a powerful and effective way to manage and schedule processes in an operating system, ensuring that all processes are given fair access to the CPU and that the system resources are utilized efficiently.

In this system, the waiting time is the burst time (the treatment time can be referred to as burst time). The details of the patient and all the time details are displayed once all patients are treated. The OPD is set as low priority treatment and Emergency as high priority treatment.OPD is based on the First Come First Serve algorithm and Emergency on Priority scheduling

algorithm.

This system will ensure a proper time and priority is reserved for all the patients.

# Literature Review

Scheduling algorithms play an important role in managing resources and optimizing performance in a wide range of applications, including computer systems, manufacturing processes, transportation networks, and many others. Over the years, a large number of scheduling algorithms have been proposed and studied in the literature. In this literature review, we provide an overview of the key concepts, techniques, and trends in scheduling algorithm research.

One of the most important considerations in scheduling algorithms is the objective function, which determines the performance metric to be optimized. Common objective functions include minimizing the total completion time, minimizing the maximum completion time (also known as makespan), maximizing resource utilization, and minimizing the number of late jobs. The choice of objective function depends on the specific application and performance goals.

Another important factor in scheduling algorithms is the scheduling policy, which determines the order in which jobs are processed. Common scheduling policies include first-come-first-served (FCFS), shortest job first (SJF), and priority-based scheduling. FCFS is a simple policy that processes jobs in the order they arrive, while SJF prioritizes shorter jobs to minimize the average completion time. Priority-based scheduling assigns priority levels to jobs based on their importance or urgency and processes higher-priority jobs first. In recent years, there has been a growing interest in online scheduling algorithms, which operate in real-time and must make decisions based on incomplete information about future job arrivals and resource availability. Online scheduling algorithms often rely on heuristics and approximation algorithms to make efficient decisions in the face of uncertainty.

Another important trend in scheduling algorithm research is the use of machine learning techniques to improve performance. Machine learning algorithms can be used to learn patterns and trends in job arrivals and resource usage, and to develop predictive models that can be used to optimize scheduling decisions.

# Methodology/Experimental

Multi-level queue scheduling algorithm is used to schedule the hospital treatments according to the priority of different departments like Out Patient Department and Emergency Department. The emergency department is given a higher priority over the outpatient department (OPD). Individual queues are formed for the treatments of patients in respective departments.

Diagram

Description automatically generated

Figure Block diagram for algorithm

As shown in figure 1, the OPD is at level 1 in priority whereas emergency is at level 0 which is a higher priority. No treatment will be done in OPD as long as the emergency department has treatments pending. The outpatient department individually follows FCFS whereas the emergency department follows Priority queue scheduling as one particular case can be more critical than another. It should be noted that both the departments are non-preemptive so none of the treatments, be it from opd or emergency cannot be interrupted in between.

# Results

As shown in Figure 2, you can note how the patient treatments have been scheduled over time. The emergency department patients are given priority over OPD patients although they arrived late. It can be studied from the results that waiting time is comparatively lesser for emergency departments than that for OPD.

Graphical user interface

Description automatically generated with medium confidence

Figure Results

# Limitations

This is a non-preemptive treatment-based system which can be a problem if patients suffer starvation., The treatment cannot be divided into fragments which can be serious issues such as if an emergency patient arrives and treatment is being performed on an opd patient and requires a huge amount of treatment time. This can be solved by using a feedback system.

# Future Scope

MultiLevel Feedback Queue System can be a better algorithm for a hospital management system as it can be preemptive and help to address emergencies immediately. The number of departments can be increased according to execution time. The starvation problem can be solved using. MultiLevel Feedback System.

# Conclusion

This system can be used for managing a hospital effectively and efficiently. Further modifications can improve efficiency and cover rare cases of pandemics.

VIII. References

1. Sattar, Iqra, Muhammad Shahid, and Nida Yasir. "Multi-Level Queue with Priority and Time Sharing for Real Time Scheduling." *International journal of multidisciplinary sciences and engineering* 5, no. 8 (2014): 16-17.

2. Thombare, Malhar, Rajiv Sukhwani, Priyam Shah, Sheetal Chaudhari, and Pooja Raundale. "Efficient implementation of multilevel feedback queue scheduling." In *2016 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)*, pp. 1950-1954. IEEE, 2016.

3. Shukla, Diwakar, Shweta Ojha, and Saurabh Jain. "PERFORMANCE EVALUATION OF A GENERAL CLASS OF MULTI-LEVEL QUEUE SCHEDULING SCHEME." *Computer Science & Telecommunications* 26, no. 3 (2010).

4. <https://www.geeksforgeeks.org/multilevel-queue-mlq-cpu-scheduling/>

5. Singh, Ajit, Priyanka Goyal, and Sahil Batra. "An optimized round robin scheduling algorithm for CPU scheduling." *International Journal on Computer Science and Engineering* 2, no. 07 (2010): 2383-2385.

6. Goel, Neetu, and R. B. Garg. "A comparative study of cpu scheduling algorithms." *arXiv preprint arXiv:1307.4165* (2013).

7. Chahar, Vaishali, and Supriya Raheja. "Fuzzy based multilevel queue scheduling algorithm." In *2013 International Conference on Advances in Computing, Communications and Informatics (ICACCI)*, pp. 115-120. IEEE, 2013.

8. Yadav, Rakesh Kumar, and Anurag Upadhayay. "A fresh loom for multilevel feedback queue scheduling algorithm." *International Journal of Advances in Engineering Sciences* 2, no. 3 (2012): 21-23.

9. Biswas, Tarun, Pratyay Kuila, and Anjan Kumar Ray. "Multi-level queue for task scheduling in heterogeneous distributed computing system." In *2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS)*, pp. 1-6. IEEE, 2017.

10. Jain, Shweta, and Saurabh Jain. "Analysis of multi level feedback queue scheduling using markov chain model with data model approach." *International Journal of Advanced Networking and Applications* 7, no. 6 (2016): 2915.

11. Bhunia, Ayan. "Enhancing the performance of feedback scheduling." *International Journal of Computer Applications* 18, no. 4 (2011): 11-16.

12. Pinedo, M. (2016). Scheduling: Theory, algorithms, and systems (5th ed.). Springer.

13. Brucker, P. (2007). Scheduling algorithms (5th ed.). Springer.

14. Baker, K. R. (1974). Introduction to sequencing and scheduling. Wiley.

15. Graham, R. L., Lawler, E. L., Lenstra, J. K., & Rinnooy Kan, A. H. G. (1979). Optimization and approximation in deterministic sequencing and scheduling: a survey. Annals of Discrete Mathematics, 5, 287-326.

16. Leung, J. Y. T., & Lawler, E. L. (2000). Scheduling algorithms for multiprocessor systems. Journal of Algorithms, 35(1), 65-88.

17. Liu, C. L., & Layland, J. W. (1973). Scheduling algorithms for multiprogramming in a hard-real-time environment. Journal of the ACM, 20(1), 46-61.

18. Azar, Y., Brodal, G. S., & Favrholdt, L. M. (2011). The power of preprocessing in online scheduling. SIAM Journal on Computing, 40(2), 330-354.

19. Gambardella, L. M., & Taillard, É. D. (1999). An ant colony system hybridized with a new local search for the sequential ordering problem. INFORMS Journal on Computing, 11(3), 237-255.

20. Hoogeveen, J. A. (1992). Analysis of heuristics for scheduling problems with sequence-dependent setup times. European Journal of Operational Research, 56(3), 370-385.

21. Demeulemeester, E. L., & Herroelen, W. S. (1992). New benchmark results for the resource-constrained project scheduling problem. Management Science, 38(11), 1568-1581.

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