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A Study Resource Optimization Techniques Based Job Scheduling in Cloud Computing

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Abstract
Cloud computing has revolutionized the way businesses and individuals utilize computing resources. It offers on-demand access to a vast pool of virtualized resources, such as processing power, storage, and networking, through the Internet. One of the key challenges in cloud computing is efficiently scheduling jobs to maximize resource utilization and minimize costs. Job scheduling in cloud computing involves allocating tasks or jobs to available resources in an optimal manner. The objective is to minimize job completion time, maximize resource utilization, and meet various performance metrics such as response time, throughput, and energy consumption. Resource optimization techniques play a crucial role in achieving these objectives. Resource optimization techniques aim to efficiently allocate resources to jobs, taking into account factors like resource availability, job priorities, and constraints. These techniques utilize various algorithms and optimization approaches to make intelligent decisions about resource allocation. Research on resource optimization techniques for job scheduling in cloud computing is of significant importance due to the following reasons: Efficient Resource Utilization: Cloud computing environments consist of a large number of resources that need to be utilized effectively to maximize cost savings and overall system performance. By optimizing job scheduling, researchers can develop algorithms and techniques that ensure efficient utilization of resources, leading to improved productivity and reduced costs. Performance Improvement: Job scheduling plays a crucial role in meeting performance metrics such as response time, throughput, and reliability. By designing intelligent scheduling algorithms, researchers can improve the overall system performance, leading to better user experience and customer satisfaction. Scalability: Cloud computing environments are highly scalable, allowing users to dynamically scale resources based on their needs. Effective job scheduling techniques enable efficient resource allocation and scaling, ensuring that the system can handle varying workloads without compromising performance. Energy Efficiency: Cloud data centres consume significant amounts of energy, and optimizing resource allocation can contribute to energy conservation. By scheduling jobs intelligently, researchers can reduce energy consumption, leading to environmental benefits and cost savings for cloud service providers. Quality of Service (QoS): Cloud computing service providers often have service-level agreements (SLAs) that define the QoS requirements expected by users. Resource optimization techniques for job scheduling can help meet these SLAs by ensuring that jobs are allocated resources in a timely manner, meeting performance guarantees, and maintaining high service availability. Here in this research, we have used the method of the weighted product model (WPM). For the topic of Resource Optimization Techniques Based Job Scheduling in Cloud Computing For calculating the values of alternative and evaluation parameters. A variation of the WSM called the weighted product method (WPM) has been proposed to address some of the weaknesses of The WSM that came before it. The main distinction is that the multiplication is being used in place of additional. The terms "scoring methods" are frequently used to describe WSM and WPM Execution time on Virtual machine, Transmission time (delay)on Virtual machine, Processing cost of a task on virtual machine resource optimization techniques based on job scheduling play a crucial role in maximizing the efficiency and performance of cloud computing systems. By effectively managing and allocating resources, these techniques help minimize costs, reduce energy consumption, and improve overall system throughput. One of the key findings is that intelligent job scheduling algorithms, such as genetic algorithms, ant colony optimization,

Keywords: MCDM**,** Execution time on Virtual machine, Transmission time (delay)on Virtual machine, Processing cost of a task on virtual machine.

1. INTRODUCTION

The way IT assets are planned and purchased is altered by the use of cloud computing, which allows for the provisioning of resources like processing units, storage space, memory, and software as services. The cost of purchasing the software and hardware needed for the introduction of applications in addition to maintenance costs had been significantly decreased thanks to the paradigm of

cloud computing. Due to the high degree of flexibility, users won't be bothered by inaccurate service adjust forecasting that could result in resource waste if overprovisioned or revenue loss if under provisioned [1]. Assigning computing duties to a resource pooling made up of numerous diverse server virtualization or virtual machines (VMs) is the fundamental working principle of computing in the cloud. As a utility with a focus on the market, cloud computing Advanced resource planning strategies, which may accommodate programmes and user programmes, tasks and processes, etc., are constantly needed to enable cloud service providers and consumers to maximise their earnings and return on investment. Scheduling, which has been deemed to be of the greatest significance to cloud calculating [2], When cloud computing becomes a viable option for various online businesses, many technology frameworks, including Google MapReduce, will be suggested to meet the needs of large data stores and highly distributed processing. running Hadoop MapReduce on atop Hadoop Distributed MapReduce was the source of inspiration for the HDFS. Hadoop separates tasks with the names map task and reduce assignment into jobs with the names map task and reduce task (3). Through the use of the cloud, all consumers and companies can access applications on demand from anywhere in the world. Computing is now a service that users receive through the cloud for computing. a basis for user demand, assets are dissected and made available to them as services. The main components that cloud providers maintain are data centres (4). cloud technology. Despite the fact that numerous scheduling techniques have been successfully used in a variety of computing environments, such as grid and clustering computation [16], and despite the likelihood of direct application of some of these techniques in cloud settings, they weren't universally accepted. At first glance, the general public heuristics may appear to be an inappropriate scheduling option for cloud duties. This study was inspired by this misconception and includes a systematic description of scheduling techniques in the context of cloud computing from a "meta-he standpoint (6). The next generation of computational paradigms is cloud computing. It is a new method of computation that is quickly seizing control of the sent computing on demand future. With the rise of virtualization-based internet-based companies, cloud computing is becoming an essential foundation. For the huge amounts of information storage and highly concurrent computing requirements of cloud computing, numerous computing frameworks are proposed e-Business, on the other conjunction, is quickly emerging as one of the most successful business models in the modern world. Computing is being changed to a model that consists of amenities that are commodities and gave in a way identical to conventional utilities like water, electricity, gas, etc. to meet the needs of internet-enabled business. Regardless of where the offerings are hosted or the manner in which they are delivered, consumers can access them based on their needs. This utility calculating has been promised by a number of computing paradigms in science. One such valid calculating paradigm is the cloud for computing. (7). User services in a distributed computing surroundings are constantly in need of multiple resources (such as CPU, I/O, memory, etc.). In addition to allocating cloud resources to meet Quality of Service (QoS) demands stated by users through Service Level Agreements (SLAs), it is also necessary to do so in order to save energy and speed up user job execution. As a result, scheduling and load balancing strategies are essential for maximising cloud arrangement efficiency while utilising constrained resources. Many researchers have looked into organising tasks in cloud computing systems in the past. (8). Since the cloud system processes so much data, performance suffers. Thus, in the realm of cloud computing, the scheduling process is crucial. The task that has been determined to have the greatest reviewed gain or benefit is planned first, and then it is carried out. However, in a system with distributed components, computing power shifts from a variety of assets to the price of resource use (9). An enhanced scheduling approach based on cost-based was used in a cloud-based computing system. Profit and cost variables are computed in this procedure when an operation will take place on a particular resource. The tasks are then divided into three groups, moderate, medium, and low, based on their respective priorities. Then, a job organising the method was utilised to complete tasks within each group. (10). Due to its features, including complete individualization, portability, accessibility on request, and loneliness, cloud computing has gained widespread acceptance. Additionally, it draws customers because it lowers the price of the services it offers while simultaneously enhancing the results. Businesses that use the cloud for computing do not have to spend money on fresh buildings or employee training. Small and Medium-Sized Businesses (SMB) may utilise the best services and applications at very low prices by using cloud computing. Cloud computing is expanding quickly in the data technology sector, and at the same time, environmental safety worries are becoming more widespread. (11). The review and analysis of online task-planning techniques. Task scheduling issues fall under the NP-Hard issue category, and numerous scheduling computations, such as heuristics, have been used to solve them. for the user to have access to the cloud, see David et (12). Businesses of all sizes can use online computing without worrying about ownership, updating, support, intellectual property rights, enrolling, etc. It has been compared to the utility computing step that came after grid computing. The "pay as you go" method of estimating prices is based on an hourly basis. (13). For arranging in cloud computing, a generic method and the cuckoo optimisation algorithm are combined. The suggested approach uses a general algorithm to schedule tasks that go to the cloud. The COA method is then used to schedule tasks after receiving the generic method's output as input (14). Virtual services are provided for resources with a variety of characteristics in a cloud computing environment. Planning successfully is essential for managing this sort of different resources in the best possible way. Numerous scheduling algorithms have been studied

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in a cloud environment. Following a quick analysis, different scheduling strategies have been categorised in this paper according to elements like time and expenditure (15). While numerous algorithms were used to efficiently plan an enormous amount of tasks, balance of load is the key to improving the efficiency of cloud computing. We've mentioned two reliable cloud scheduling algorithms, including the Max-Min and Minimum The execution Time computation. In our analysis, we tested that the Particle Swarm Optimisation algorithm produces results that are comparably better in terms of typical scheduling period and the ratio of effective execution. Therefore, the business accomplishment in the wireless sector is improved by our suggested method. Future work will focus on developing an effective load balancing algorithm that works in both real-time environments with high and low load factors (16).

2. MATERIALS AND METHODS

Execution time on Virtual machine: The execution time on a virtual machine can vary depending on several factors, including the hardware resources allocated to the virtual machine, the complexity of the task being executed, the efficiency of the virtualization software, and the workload on the host machine. Virtual machines (VMs) run on top of a physical host machine and share its resources, such as CPU, memory, and storage. The performance of a VM is influenced by the resources allocated to it. If a VM is allocated more CPU cores, higher memory capacity, and faster storage, it will generally have better execution times.

Transmission time (delay)on Virtual machine: The transmission time or delay on a virtual machine (VM) can be influenced by several factors, including network latency, virtualization overhead, and the workload on the VM and the host machine. Network Latency: Network latency refers to the time it takes for data packets to travel between the VM and other network endpoints, such as servers, clients, or other VMs. The latency can be affected by factors such as the distance between the endpoints, network congestion, and the quality of the network infrastructure. Higher network latency can result in longer transmission times and delays in data transfer.

Processing cost of a task on virtual machine: The processing cost of a task on a virtual machine (VM) can depend on various factors, including the complexity of the task, the allocated resources, the efficiency of the virtualization software, and the workload on the host machine. Complexity of the Task: The processing cost of a task is influenced by its computational requirements, memory usage, and I/O operations. Tasks that are computationally intensive or require a significant amount of memory or disk access may have higher processing costs compared to less demanding tasks.

Method:

A variation of the WSM called the weighted product method (WPM) has been proposed to address some of the weaknesses of The WSM that came before it. The main distinction is that the multiplication is being used in place of additional. The terms "scoring methods" are frequently used to describe WSM and WPM. A member of the more recent creation of MCDM techniques is the weighed aggregated sum product assessment (WASPAS) put forth by 15. The weighted total model (WSM) and weighted product model (WPM) addresses are two well-known addresses that are combined in this way (26). distinct descriptions of computing in the cloud are being developed by analyst companies, academics, industry professionals, and IT firms. Table 1 lists a variety of descriptions of online computing from various analyst firms (27). The weighed product, in which matrices are combined random, in which an arbitrary unbiased is chosen to be optimised at each step. When the weights are used to aggregate numerous matrices, two approaches can be employed to determine the weights that are used at every stage of the method dynamically: fixed, in which we can give to all ants the identical weight and every goal has the same significance throughout the method run; and assigning each ant a weight that differs from the rest of the ants at each repetition (28). Our method yielded a total of three clusters. The clustering empathy calculation was subsequently performed using a weighted product model. Three values, one for each, have been calculated obtained through the use of this product model (29). This paper proposes a novel approach that utilises online computing and enhanced k-means method. The precision of the method for clustering is increased through the enhanced k-means method, and its parallel processing on the basis of the MapReduce model increases the algorithm's effectiveness (30). The interaction between both of these hierarchies must be taken into account. With this particular approach, every hierarchy is viewed as a single component, and corresponding priorities are calculated after comparisons of pairs with respect to an unique order (31). Manually choosing the best option is very time-consuming. Consequently, a scalable and computerised method of cloud buying resources is required. Although cloud vendors are not yet providing standardised services, Rochwerger et al. note that this will need to change and that the "federated cloud has enormous potential." In such a scenario, it would be feasible to combine and swap resources provided by various cloud vendors and streamline the acquisition of the aforementioned assets (32). Due to its intellect and implied concurrency, artificial intelligence techniques like evolutionary computation, particularly when used in neural networks, have gradually gained attention (33). The corresponded to model approach can have biases against new goods and quality. A matched model cannot account for the implicit cost change brought on by an improvement in the product's quality; this bias is known as excellence bias (34). The Weighted Product Method (WPM), a technique from the field of multifaceted decision-making, is recognised as a straightforward, lightweight,

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yet effective method of contrasting substitutes in terms of numerous criteria, not always presented in the same units (in contrast to a similar, yet less useful, approach). Method of Weighted Sums (35). In the event that there are multiple pheromone matrices that the pheromone matrix collection and a heuristic function must be used. The weighed sum, the weighted product method, and choice at random are among the most frequently used operations (36). There are only two levels of priority overall: high and low. Every node begins with a low priority. It is anticipated that traffic that is permitted to move to a higher priority will receive better service. In the following section, alternative approaches to raising a particular node's priority are provided (37). The WASPAS technique combines the weighted sum method (SAW) and the weighted product method, two multifaceted decision-making techniques. The individuals involved in the MABAC method calculate the separation between each alternative's standards operate and the border's approximation area (40). the one that is closest in weight to PM2, the ideal PM, which is PM1. However, after moving VM2 to PM2, PM2's memory usage rises to 0.51 percent, which is above the threshold. Next, TOPSIS must perform another relocation, and it decides to shift VM2 to PM1. RIAL calculates a comparable ideal PM as TOPSIS, but weights memory more heavily. As a result, it selects PM1 as the location with the briefest weighted distance (41). decision support system can perform the process of calculating employee performance appraisal with the best value results, so as to realize a fair assessment based on existing criteria calculated on this system using weighted product weighting (WP) that can produce the best employee performance appraisal system calculation from the highest value up to the lowest value. The highest score is the best employee while the lowest score is the worst employee performance (45).

3. RESULT AND DISCUSSION

TABLE 1. Resource Optimization Techniques

	Execution time on Virtual machine	Transmission time (delay) on Virtual machine	Processing cost of a task on virtual machine
Task 1	0.1343	0.1288	0.1359
Task 2	0.1678	0.1717	0.1699
Task 3	0.2014	0.2147	0.2039
Task 4	0.235	0.2576	0.2378
Task 5	0.2685	0.3005	0.2718
Task 6	0.3021	0.3435	0.3058
Task 7	0.3468	0.3649	0.3511
Task 8	0.3916	0.3864	0.3964
Task 9	0.4363	0.4079	0.4417
Task 10	0.4811	0.4293	0.487

Table 1 Show the Resource Optimization Techniques Based Job Scheduling in Cloud Computing in Execution time on Virtual machine, is Highest value: 0.4811, Lowest value: 0.1343 Transmission time (delay) on Virtual machine is Highest value: 0.4293, Lowest value: 0.1288 Processing cost of a task on virtual machine having is Highest value: 0.487, Lowest value: 0.1359.

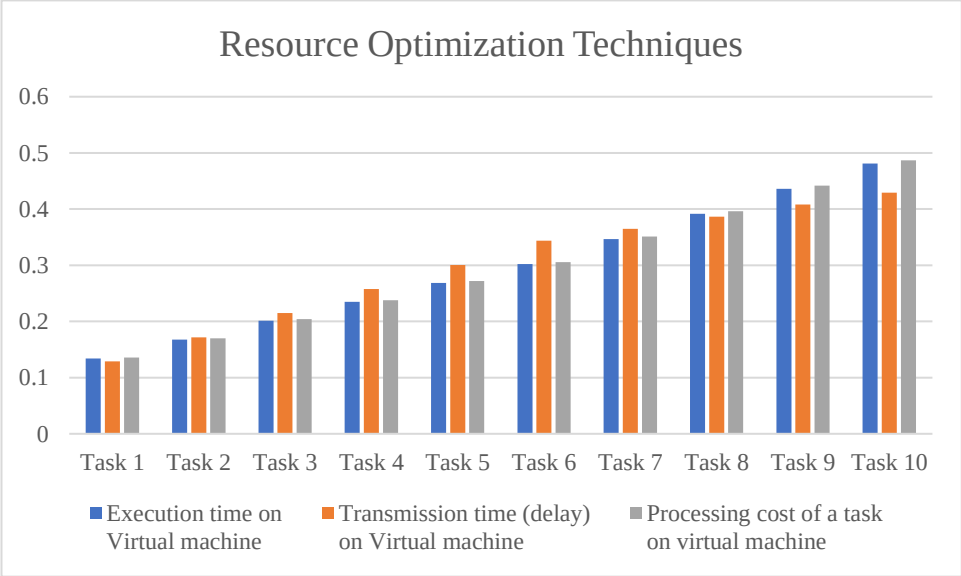

FIGURE 1. Resource Optimization Techniques

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TABLE 2. Performance Value

Performance Value		
Execution time on Virtual machine	**Transmission time (delay)on Virtual machine**	**Processing cost of a task on virtual machine**
0.2791519	0.2677198	0.2824777
0.348784	0.3568905	0.353149
0.418624	0.446269	0.4238204
0.4884639	0.5354396	0.4942839
0.558096	0.6246103	0.5649553
0.627936	0.7139888	0.6356267
0.7208481	0.7584702	0.7297859
0.813968	0.8031594	0.8239451
0.9068801	0.8478487	0.9181043
1	0.8923301	1.0122636

Table 2. Performance Value Execution time on Virtual machine: Highest value: 1 Lowest value: 0.2791519 Transmission time (delay) on Virtual machine: Highest value: 0.8923301 Lowest value: 0.2677198 Processing cost of a task on virtual machine: Highest value: 1.0122636 Lowest value: 0.2824777.

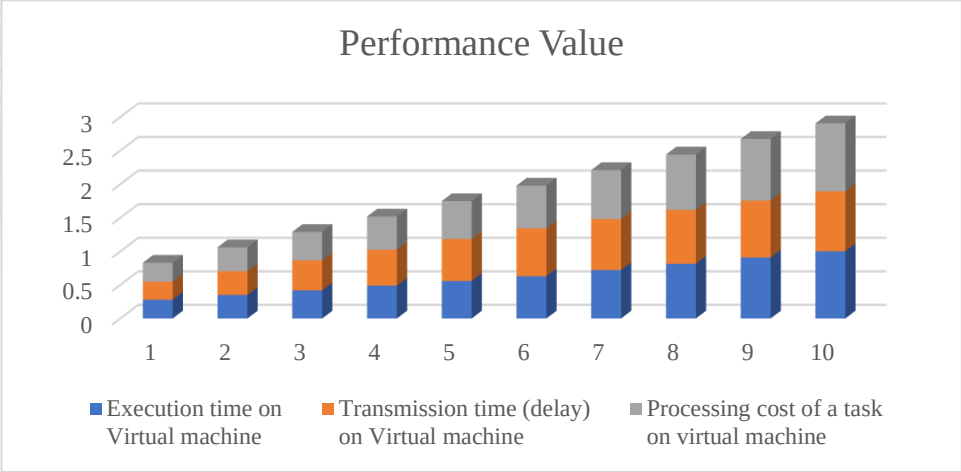

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TABLE 3. Weightages

WEIGHTED		
Execution time on Virtual machine	**Transmission time (delay)on Virtual machine**	**Processing cost of a task on virtual machine**
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333

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0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333
0.3333333	0.3333333	0.3333333

The above table 3, shows us the WEIGHTED value method of the topic Resource Optimization Techniques Based Job Scheduling In, Cloud Computing and how each value are related.

TABLE 4. Weighted normalized decision matrix

Weighted normalized decision matrix		
Execution time on Virtual machine	**Transmission time (delay)on Virtual machine**	**Processing cost of a task on virtual machine**
0.6535521	0.6445058	0.6561373
0.7039128	0.7093245	0.7068371
0.7480685	0.7641857	0.7511511
0.7875489	0.8120264	0.7906644
0.8233219	0.8548102	0.8266811
0.8563247	0.8937796	0.8598065
0.8966327	0.9119678	0.9003233
0.9336894	0.9295382	0.9374888
0.9679434	0.9464684	0.9719204
1	0.9627389	1.0040713

The above table 4, shows the weighted normalized decision matrix provided, we can identify the highest and lowest values for each category: execution time, transmission time, and processing cost. Execution time on Virtual machine: Highest value: 1 Lowest value: 0.6535521 Transmission time (delay) on Virtual machine: Highest value: 0.9627389 Lowest value: 0.6445058 Processing cost of a task on virtual machine: having Highest value: 1.0040713 is Lowest value: 0.6561373.

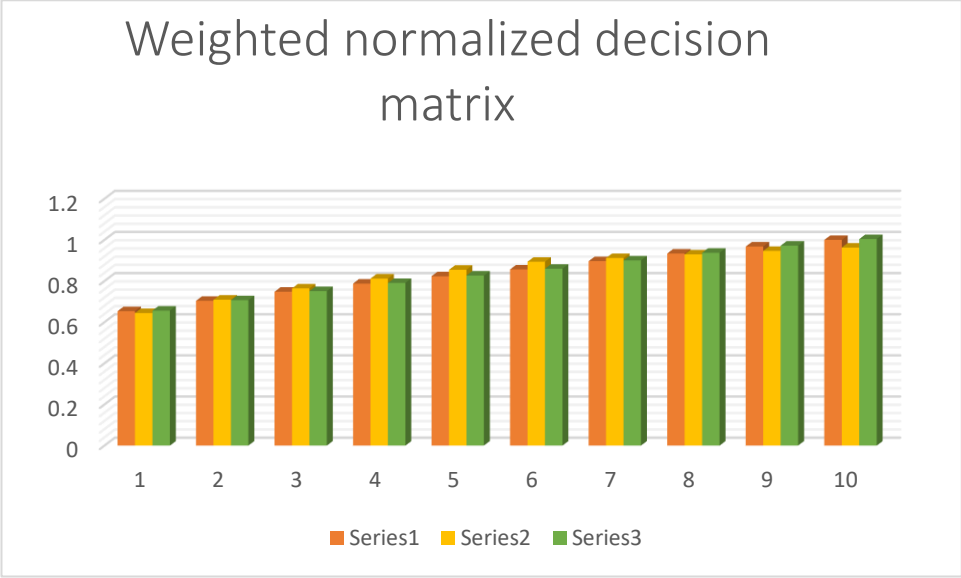

FIGURE 3. weighted normalized decision matrix

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TABLE 5. Final Result

Task 1	0.2763769	10
Task 2	0.3529256	9
Task 3	0.4294055	8
Task 4	0.5056381	7
Task 5	0.5818049	6
Task 6	0.6580663	5
Task 7	0.7361945	4
Task 8	0.8136466	3
Task 9	0.8904033	2
Task 10	0.9666584	1

Table 5 shows the Final Result

Table 5 shows the Final Result Task 10: Execution time: showing is having the Highest value: 0.9666584 showing is having Task 1: Execution time: Lowest value: 0.2763769.

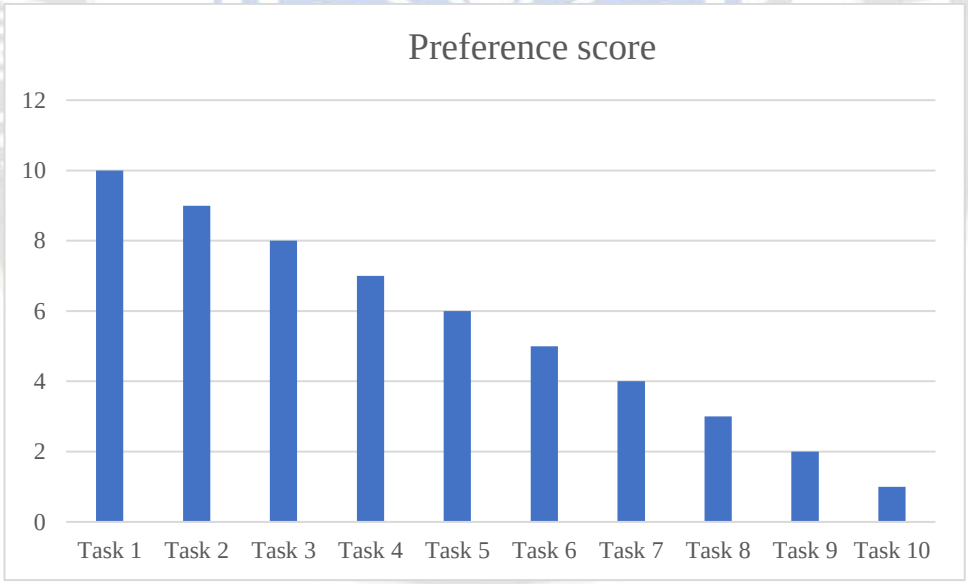

FIGURE 4. Preference score

Figure 4 shows the Final Result Task 10: Execution time: showing is having the Highest value: 0.9666584 showing is having Task 1: Execution time: Lowest value: 0.2763769.

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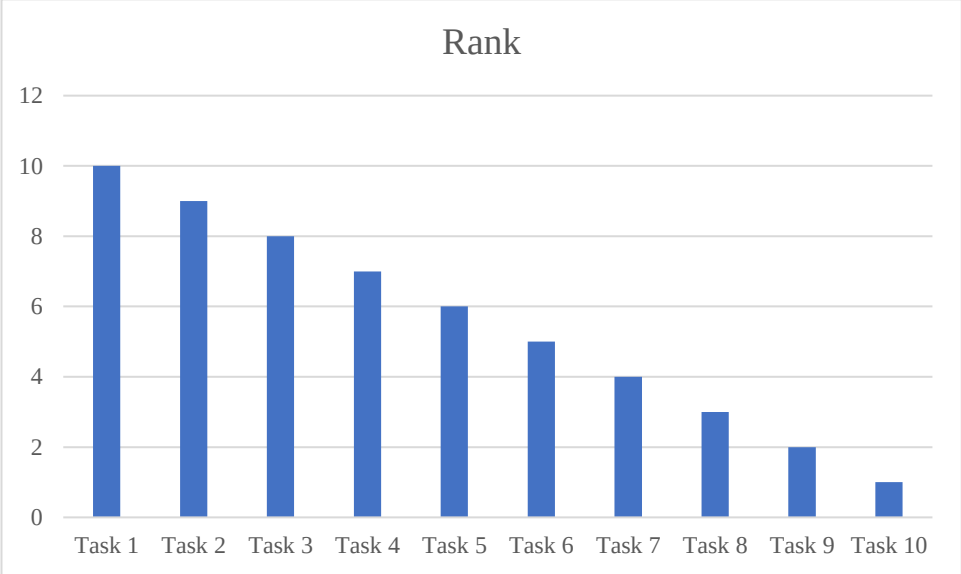

FIGURE 5. Rank

Figure 5 shows the Rank Task 10: Execution time: showing is having the Highest value: 0.9666584 showing is having Task 1: Execution time: Lowest value: 0.2763769.

4. CONCLUSION

In conclusion, resource optimization techniques based on job scheduling play a crucial role in maximizing the efficiency and performance of cloud computing systems. By effectively managing and allocating resources, these techniques help minimize costs, reduce energy consumption, and improve overall system throughput. One of the key findings is that intelligent job scheduling algorithms, such as genetic algorithms, ant colony optimization, and particle swarm optimization, can significantly enhance resource allocation in cloud environments. These algorithms consider various factors, such as job priority, resource availability, and task dependencies, to make informed decisions and optimize resource utilization. Moreover, dynamic resource provisioning techniques enable the system to adapt to changing workload conditions. By continuously monitoring resource usage and workload patterns, these techniques can scale resources up or down in real-time, ensuring efficient resource allocation and meeting service level agreements (SLAs). Furthermore, the integration of machine learning and artificial intelligence techniques in job scheduling can bring further improvements. By leveraging historical data and learning patterns, these techniques can predict future resource demands and optimize scheduling decisions accordingly. This helps in proactive resource management and avoiding potential bottlenecks or performance degradation. Overall, resource optimization techniques based on job scheduling in cloud computing have shown great potential in achieving efficient resource utilization, cost reduction, and improved system performance. With the rapid advancement of technology and the increasing complexity of cloud environments, further research and innovation in this area will continue to drive advancements and pave the way for more intelligent and optimized cloud computing systems. shows the Rank Task 10: Execution time: showing is having the Highest value: 0.9666584 showing is having Task 1: Execution time: Lowest value: 0.2763769.

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