# Application of CPU job scheduling in an earthquake

## Aman Mangal[1], Prof. Prabakaran N.[2]

*[1] U.G. student, Department of CSE,Vit University,Tamil Nadu, India*
*[2] Prof. Prabakaran N.,Department of CSE,Vit University,Tamil Nadu, India*

---------------------------------------------------------------------***--------------------------------------------------------------------

**Abstract -** *Out of all natural disasters one of the hardest to escape is earthquake .There is huge life loss every year due to earthquake. To prevent casualties during earthquake we can apply CPU Scheduling which is of five ways: FCFS, SJF, SRTF, PRIOTRITY, ROUND ROBIN. In this paper we would discuss the case what we have to do when a earthquake is struck in a city and discuss the case in which we can apply the job scheduling algorithms in it so that the people can be help by treating the people of the city as a program in a CPU and their help as allocating the CPU resource to them. We would compare in which situation which algorithm is better and convenient to use among the above mentioned scheduling algorithms and when we should avoid a particular algorithm. We have proposed a six tier model of E.P.M that is Earthquake Prevention Model by following which the casualties could be minimised as it lay the steps to be followed in an earthquake like evacuation , medical help , reallocation.*

**Key Words**: CPU Scheduling , Earthquake ,FCFS, SJF,SRTF,Round Robin,Priority
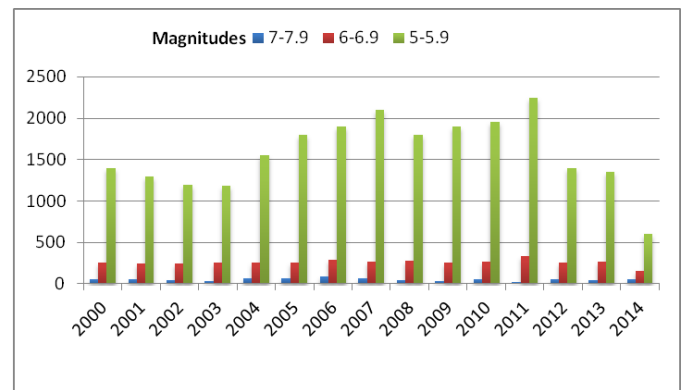
## 1.INTRODUCTION

### Worldwide Earthquakes 1990-1999

Every year there are thousands of deaths worldwide due to earthquake. According to a survey there are more than 25,000 deaths of people per year due to earthquakes all over the world. Per year there are approximately 1,400 earthquake of moderate magnitude of 5 to 6 every year plus 200 earthquake of strong magnitude 6-7 every year. In year 2004 the death toll due to earthquake was recorded to as high as 2,80,000 . These stats call to a measure to ensure that we can predict the earthquake in future and moreover be prepared to have counter measures ready so that the casualties could be minimised to a large extent.

| Magnitude | 8+ | 7-7.9 | 6-6.9 | 5-5.9 | Estimated deaths |
|---|---|---|---|---|---|
| **1990** | 0 | 17 | 108 | 1616 | 52055 |
| **1991** | 0 | 15 | 95 | 1456 | 3209 |
| **1992** | 0 | 12 | 165 | 1497 | 3919 |
| **1993** | 0 | 11 | 136 | 1425 | 10097 |
| **1994** | 2 | 10 | 145 | 1541 | 1635 |
| **1995** | 2 | 17 | 182 | 1317 | 7979 |
| **1996** | 1 | 13 | 148 | 1221 | 587 |
| **1997** | 0 | 15 | 119 | 1112 | 3068 |
| **1998** | 1 | 10 | 116 | 978 | 9425 |
| **1999** | 0 | 17 | 115 | 1103 | 22660 |

### Earthquakes 2000-2014



## 1.1 CPU scheduling

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

CPU Scheduling is referred to as the process of choosing the programs which are present in the ready state in the memory of CPU and allocating the CPU resources to them. The main aim of CPU scheduling is to improve the efficiency of CPU , to make it fast and make sure that it is not biased to any of the process. Thus it make sure that the CPU is not idle and is processing process all the time so that maximum efficiency can be achieved all the time.

### 1.1.1 FCFS

First come first serve also known as FCFS. As the name suggest it is the algorithm in which the program which is

first in the line of execution is executed first and don't consider the burst time and any priority as its criteria .The only criteria is the arrival time, the process arriving first is executed first .Suppose if all the program has arrived at the same arrival time let say at the beginning only then it process the resource allocation based on the alphabetical order alone. It can be seemed as a algorithm which is based on the model of FIFO .It is the simplest algorithm to be implemented as there are no major criteria for resource allocation. The algorithm is an example of a non pre-emptive based algorithm as there is no waiting once the resource is allocated it will be free only after the completion of the program assigned. Thus it is not the ideal algorithm in every case as the waiting time for a program in certain cases are very high which will be discussed in detail in later .

## 1.1.2 SJF

Shortest job first also known as SJF. As you can guess from the name in this algorithm the process which has the shortest burst time in the entire list of programs is selected for execution. The algorithm is an example of non pre-emptive type of algorithm in which the resource given to a program is released only after it complete the execution of the program completely .So if suppose all the programs has arrived at the same arrival time it will execute the program having shortest burst time irrespective of the alphabetical order which was done in the case of FCFS. In all of the algorithm present it has the minimum waiting time so it can be considered as a better choice of algorithm since the waiting time is less in it so it can be beneficial during a disaster management as the persons should have to wait less for their chance to come to set some help or if the authorities want to select the patient the chance is higher as the waiting time is less in it.

## 1.1.3 SRTF

SRTF is also known as shortest remaining time first. It is a change of SJF algorithm in a way that it now behaves as a pre-emptive type algorithm. It works as a pre-emptive algorithm when suppose there is a program executing but suddenly another program arrives which possess a shorter burst time than the current processing program in this scenario the new arrived program will be executed first instead of the already executing program. It has even low average waiting time  than the SJF making it the algorithm which have the least waiting time in all of the scheduling algorithms .In disaster management it will play a crucial role because of it having the less waiting time thus help can be reached to a person quickly as he will have to wait for less time .

## 1.1.4 Priority

In this algorithm the selection of which process should be executed first is done on the priority assigned to the given process , for e.g. if there are 3 process with priority 1,2,3 the process with priority 1 will be executed first followed by 2 then 3 irrespective of the burst time of individual process. The main issue with priority is that there is a high chance of starvation of the process with least priority as it may happen that the highest priority process may have a huge burst time due to which other process may have to wait for a huge time. In our scenario it is helpful in the case that if suppose 2 people are stuck in a building the person with injuries would be given a higher priority while rescuing than the person which are having no or minimal injury as it will increase the chance of survival of critical patients in this case it will be really helpful to use priority scheduling.

## 1.1.5 Round Robin

Round Robin is a type of algorithm which is unbiased in nature it divides the time of execution equally to all process by giving them a time quantum to each of the process present in the queue . Then the individual process is allowed to use CPU to complete it execution for a certain amount of time if it is not able to complete it process in the given amount of time the CPU resources are assigned to the next process in the queue and the process being executed is made to stand last in the queue so that it will get a chance after all process has got their chance. It is used in the scenario when all patients have to give first aid so that more and more patients can be treated fairly.

## Characteristics of Scheduling algorithm

|  | Advantages | Disadvantages |
|---|---|---|
| FCFS | 1)Simple to apply 2)Starvation is not possible | 1)Average waiting time is very high 2)There is a chance of convoy effect happening 3)Non pre-emptive in nature 4)High Turnaround time |
| SJF | 1)High throughput 2)Low average waiting time 3)Very Low turnaround time | 1)Starvation is possible 2)Non pre-emptive in nature |
| SRTF | 1)Good response time 2)Pre-emptive in nature | 1)Not fair in case of big jobs 2)High turnaround time 3)Starvation is |

| | | possible |
|---|---|---|
| Priority | 1)Key jobs are executed first 2)Both pre emptive and non-pre emptive 3)Aging is there | 1)Starvation is possible 2)Biased in nature |
| Round Robin | 1)Fairest in nature as each process get equal chance 2)No Starvation 3)Low response time | 1)If time quantum increase it will behave as FCFS 2)If time quantum is less it may result in decrease CPU efficiency |

## 2. Proposed model: Earthquake Prevention Model [E.P.M]

Whenever an earthquake occur there is a huge loss of life to minimize it we can follow our following model so that the destruction and casualties can be minimized to a greater extent . It is a 6 tier architecture in which first level show the first and immediate step we should take in an earthquake then second step of contacting information and broadcasting helpline then come basic first aid followed by proper medical attention then food distribution and collection then finally last step of checking of buildings and gas lines and electricity lines and reallocation to a temporary basis for some people .The complete order is as following:

1. Evacuation
2. S.O.S services
3. First aid
4. Medical attention
5. Food collection and distribution
6. Checking and reallocation



## 2.1) Evacuation

The first course of action whenever an earthquake occur to avoid fatal casualties is evacuation strategies. We will need a proper evacuation route from which we can finish evacuation in shortest possible time thus we will use SJF in this case as it will tell us the shortest job or route which should be taken , thus if the shortest route is taken maximum no of people can be evacuated successfully and the death toll can be reduced.

## 2.2) S.O.S services:

After evacuation the most important service is an S.O.S service ,that is the government should broadcast information ,helpline number that individual could call to gather information about which area to avoid , which is the safest location nearby them , it can also be used to inform nearby authorities that you are in danger and need immediate help, moreover you could also request the location of your family to help them .For an S.O.S service we could use the help of Round Robin algorithm in which the time quantum for a process should be minimum of 30 sec that allow all process to be quickly solved and will allow that all the people are helped are properly.

## 2.3) First- aid

After evacuation we should provide quick basic first- aid to the people so that the no of casualties could be stopped . The patients should be served on basis of Round Robin algorithm with the time quantum of few minutes , this would insure that more and more patients are treated and their basic injuries are treated as fast as possible.

## 2.4) In a medical camp or hospital

When the casualties of earthquake are being treated after the earthquake , the people which are having more severe injuries and children should be treated first than other patients as they are in a more critical situation. For the situation we can use priority scheduling algorithm by assigning the patients priority on the basis of following parameters:

- Condition of patient
- Age
- Gender

where condition of patient being the most important factor thus having the highest priority then the age after that gender.

In the above situation we cannot use FCFS as if the patients are treated on first come basis ,some patients which are in a

critical situation may not be able to survive as they can't receive proper medical attention due to high waiting time in queue.SJF also cannot be use as the patient with larger issues will not be able to get quick response and that may lead to increase in casualties number.

## 2.5) Food collection and distribution

After treatment of patients with injuries the next major step is to provide the patients with food but for it first we have to collect the food for that we will use SJF as it will tell us the shortest route to collect the food from the food store or government stores and then after collection of food we will use the food collected to distribute it to the needed people for that we will use both FCFS as well as priority scheduling in the sense that food will be distributed to whoever comes first but if suppose a person who is in more need of food ,arrives he shall be given more priority and thus should be given food first .The parameters for finding priority will be same as in the case of above scenario of medical camp

## 2.6) Checking and Reallocation

Before sending the people back to their respected places we should check their buildings for safety whether they are in proper shape or not and its foundation of building is undamaged or not moreover we should also check if there is any gas leakage or is there any electricity lines that are broken .If there is we should first treat it before sending the people back to their houses . The algorithm which we could use to map the area to be search is FCFS as the searching should be start from one point till the last point in a proper order to make sure that all the area are properly searched. Furthermore we also have to provide the settlement for people on a temporary basis for people whose building are destroyed in the earthquake. For it we will use priority scheduling as some might needed it more due to their financial and physical condition than the rest of the people.

## 3. Conclusion

After designing the model we came to the conclusion that if the following models were used in the previous scenarios of earthquake many of the lives would have been saved . Because of not presence of any well defined procedure there was no proper action step taken resulting in a huge life loss . The model should be followed in the correct order of sequence only to have the maximum output from the model . Because of the use of CPU scheduling the process of prevention of people in earthquake can be handled with a better result as it lays down priority and other basic rules such as order of execution of events whether it be related to evacuation and reallocation of people back to their buildings or providing medical attention.

## 4. Results

The model was successfully designed which states the order in which the events should be carried out in the case of an earthquake .The model lay out the guidelines to be followed in each of the 6 steps discussed and which type of job scheduling should be use and preferred in each case which will lead to maximum effectiveness of model .

## REFERENCES

[1] https://earthquake.usgs.gov/earthquakes/browse/stats.php

[2] http://www.scirp.org/journal/ojer/

[3] National Disaster Risk Reduction and Management Council (NDRRMC) - http://ndrrmc.gov.ph

[4] National Mapping and Resource Information Authority (NAMRIA) -http://www.namria.gov.ph

[5] https://www.scbaghdad.edu.iq/projects/computer/20102011/4.pdf