**Earthquake Prevention Model**

**Stages of the Model**

**Initialization**

Randomly populate the environment with people and properties. Each person has the following attributes: person ID, location, gender, age, financial status and health points. Each property has the following attributes: property ID, a list of person IDs representing the residents, location and damage points.

Generate an earthquake and set the red zone. This includes randomly generating an epicenter and a magnitude between 7 and 10. The magnitude will be proportional to the radius of the red zone. Each person inside the red zone will become critical points. The health points of the people inside will drop from 100 to a random number.

For every critical point, decrement the health by 1 every T1 minutes until the person is processed at the first aid camp and decrement by 1 every T2 minutes until the person is processed at the medical camp. (T2>T1)

**Evacuation – SJF**

Randomly generate N evacuation centers with a predefined limit within the red zone. Each of the critical points will move towards one of the N points and once the limit is reached or when no more points are gathering at the center, signal the relief camp for evacuation (arrival time). The relief truck will drive to the evacuation center, pick the people up, and drive back to the relief camp. Evacuation center will be chosen based on shortest distance from relief camp (burst time).

**SOS services – Round Robin**

Randomly generate points requesting for an SOS service (originating from both inside and outside the red zone). Each of these points will have a time of call (arrival time) and duration of call (burst time). Process these calls in a round robin fashion. This process will start right after the earthquake hits, when the government broadcasts a helpline number.

**First Aid – Round Robin**

People from the red zone will arrive at the relief camp at a particular time (arrival time). This time will be same for people coming from one evacuation center and different for people coming from different centers. For each of these people, the burst time is calculated as (x\*t1)/2 where x is the health when they arrive at the relief camp and t1 is the time taken to boost the health by 1 point.

**Medical attention – Priority**

Once a person has been treated with first aid at the relief camp, he/she will be moved to the medical camp for full medical attention (arrival time). The burst time here is calculated as (100-x) \*t2 where x is the health when they arrive at the medical camp and t2 is the time taken to boost the health by 1 point. Priority is calculated as a combination of the person’s health status, age and gender.

**Food collection and distribution – SJF and Priority**

The process of food collection starts after the evacuation phase is completed. Randomly setup N food sources in the map. When a food source is setup, it will send a signal indicating its ready state (arrival time). Obtain these food source in a shortest-distance fashion (burst time).

When a person is fully nursed back to health at the medical camp, he/she will move to the food distribution center (arrival time). The burst time of each person is a representative of his/her hunger level. Hunger level is calculated as (100-x) \*h where x is the original health level after the earthquake hit and h is the amount of energy the person needs to absorb 1 health point obtained at the medical and relief camp. Food will be distributed to the people on a priority basis with the priority being calculated as a combination of the person’s health status, age and gender.

**Checking and reallocation – FCFS, SJRF and Priority**

The checking process will start after the evacuation phase has been completed. An inspection camp will be setup at the epicenter of the earthquake. The arrival time could be the time at which the debris surrounding the property is cleared and the property sends a signal indicating that it is open for inspection. The burst time of the property is its distance from the epicenter. When a signal is received, an inspector from the inspection camp visits the property to assess the damage (FCFS manner).

If the damage points are greater than 50, the property has to be scheduled for fixing and patch up work and the residents have to be temporarily reallocated. The property is sent to be fixed after inspection (arrival time) and the burst time is calculated as (x-50) \*t3 where x is the damage level and t3 is the time to fix 1 damage point. The properties could be patched up in a SJRF manner.

The residents of the property will be signaled for reallocation after the inspection reveals a damage level of greater than 50 (arrival time). The residents will be allocated temporarily shelters on a priority basis with the priority level being a combination of financial status and (100-x) where x was the original health status when the earthquake hit. The burst time is equal to the completion time of the property that was scheduled for patch up.

**Working of the Model**

**Initialization**

When the earthquake is generated, all the people and houses inside the red zone will turn red. The console will log the earthquake displaying the magnitude, number of people affected and number of houses damaged. Another message saying “Evacuation in progress” will be displayed. In the Status tab, the list of all the people will be shown and can be used to track the status of each individual person throughout the simulation. Each list item will consist of the following attributes: the person ID, health points, current stage of the model and a column showing the individual log. The individual log will display the waiting time and turnaround time output of every stage for every person.

**Evacuation**

Immediately after the earthquake hits, each point will be assigned to an evacuation center and their color will turn to a darker shade of red. Evacuation centers will be yellow in color. At this stage, the individual log of the person will display the distance to the evacuation center (in the status tab). When a person reaches an evacuation center, his color will turn yellow (same as that of the center). Once the buffer time elapses, the console will log a message saying “x people at evacuation center y, signaling for pickup” and the color of the center and its people will turn into a darker shade of yellow. The center enters the SJF scheduler as a process waiting to be executed. A truck is then sent for pickup. Once all the evacuation is complete, console logs a message saying “evacuation complete” and the individual log values are cleared in the status tab. When the truck reaches the relief camp, TT and WT of all the people in the truck will be displayed in the individual log.

**First Aid**

When a person arrives at the relief camp, his color will turn blue (The relief camp is also blue in color). All processes will be assigned to the RR scheduler. Console will log this by saying “x people arrived at relief camp”. When a process is complete, its TT and WT will be displayed in the individual log its color will turn to cyan. This process will then be assigned to the medical camp. When all processes are complete in the first aid camp, the console will log a message saying “First-aid administered to all victims”.

**Medical camp**

Processes coming into the medical camp will be cyan in color. When the first person arrives at the medical camp, console will log a message saying “medical camp open”. When a process is complete, its color will turn green and its TT and WT will be displayed in its individual log. When all processes complete, console will log a message saying “Medical attention provided to all victims”.

**Food distribution**

When the first process moves out of the medical camp into the food distribution center, console logs a message saying “food distribution center open”. When a process is complete, TT and WT is logged and its color turns to a shade of grey (similar to the color of the rest of the population) or purple, if they have to be reallocated. When all processes complete, console logs a message saying “food distribution complete”.

**TBD after evacuation**

*Food collection:* Food sources will be orange in color. Note the time when evacuation is complete (say N). Set up food sources to signal (i.e., turn orange in color at some point outside the red zone) at a time range that is between N and N+5 minutes. When signaled, console logs a message saying “food source available for pickup”. Truck moves from relief camp to source, and then back from source to the food distribution center. When this stage is complete console logs “Food collection complete”

*Checking and reallocation:*  Once evacuation is complete setup an inspection center at the epicenter (purple color). Note the time when evacuation is complete (say N). Set up houses to signal at a random time between N and N+5 minutes. When a house signals, color changes to orangish-yellow and console logs “Debris cleared, house x ready for inspection”. It then moves into the FCFS scheduler for inspection. After being processed, if damage points are greater than 50, change house color to purple, otherwise change to grey. Purple houses move to SJRF scheduler for patch-up and console logs “House x scheduled for patch-up”. Note the residents of the purple houses, their colors have to turn purple when they come out of the food distribution center and be moved into the reallocation center.

In the status tab, under the list of people will be the list of houses. Each house will have an ID along with its resident IDs, damage points, stage of the model and individual log. Log TT and WT as house comes out of every scheduler. When house color turns from purple to grey, its corresponding residents color also turn to grey (only after they come out of the food distribution center). Once all residents and houses turn grey, remove the red zone and log “Model Complete” . Also log the total victims, total deaths and total lives saved. In the status tab, display a table at the bottom showing the average TT and WT of all the stages.

**Parameters of the Model**

|  |  |
| --- | --- |
| T1 | 10 minutes |
| T2 | 15 minutes |
| *Population* | |
| 6-7 | 40 |
| 7-8 | 60 |
| 8-9 | 80 |
| 9-10 | 100 |
| *Houses* | |
| 6-7 | 10 |
| 7-8 | 15 |
| 8-9 | 20 |
| 9-10 | 25 |
| *Area of Red Zone* | |
| 6-7 | 10Km |
| 7-8 | 20Km |
| 8-9 | 30Km |
| 9-10 | 40Km |
| *Initial Health* | |
| 6-7 | 30-40 |
| 7-8 | 20-30 |
| 8-9 | 10-20 |
| 9-10 | 0-10 |
| *Evacuation Centers* | |
| 6-7 | 2 |
| 7-8 | 3 |
| 8-9 | 4 |
| 9-10 | 5 |
| Buffer time | 10 minutes |
| *SOS Round Robin* | |
| Time Quantum | 2 minutes |
| Burst time | 1-5 minutes |
| *First Aid Round Robin* | |
| Time Quantum | 10 minutes |
| t1 | 5 minutes |
| *Medical Priority* | |
| Priority | F |
| t2 | 10 minutes |
| *Food Collection - SJF* | |
| 6-7 | 3 |
| 7-8 | 4 |
| 8-9 | 5 |
| 9-10 | 6 |
| *Food Distribution - Priority* | |
| Priority | F |
| h | F |
| *Reallocation – SJRF and Priority* | |
| Priority | F |
| t3 | 30 minutes |