1. Hey my name is Charles; this is my final project. I made an Emergency Room Simulation for Mass Casualty Incidents
2. So, a brief overview: First I’m going to give a little motivation and background for this project.
   1. Then I’m going to go over the model and its components: entities, resources, and processes.
   2. Then I’ll go over the simulation I made and its parameters, and some output analysis. Finally, I’ll give a brief summary of what we learned.
3. The motivation of this project comes from recent attention to the prevalence of mass casualty incidents around the world and especially in the United States. Things like the Paris attacks in 2015 with multiple incident locations, the Las Vegas shooting in 2017 which happened in one location, and other incidents such as American school shootings.
4. We modeled a one location mass casualty incident with multiple hospitals and multiple ambulances.
   1. Each hospital has its own set of doctors/resources.
   2. Although not realistic, we assume the ambulances are all already on site and that any ambulance can take a patient to any hospital
5. The entities in our model are patients. We classify patients based on Triage class using START: immediate or delayed based on their breathing rate, heart rate, circulation, and ability to obey simple commands.
   1. Immediate and Delayed class patients differ in their service time at the hospital, hospital resources needed, and have differing survival probabilities but they can all go to any hospital, be picked up by any ambulance, and are all at the same location
   2. Each “Patient” has six attributes: Triage class assigned at initialization,
   3. The hospital they’re going to assigned at pickup initialized to -1
   4. their arrival time to the hospital assigned at pickup initialized 10 to the 30
   5. their departure time from the hospital assigned upon entering service initialized 10 to the 30
   6. their survival probability assigned once they enter service initialized to 0
   7. and their current location either the scene, an ambulance, the hospital, or departed initialized to the scene
6. The first resource that we include in our model is the Ambulance object. Ambulances can pick up patients of both triage classes, can go to any hospital, and are assumed to initially be on site at the beginning of the simulation.
   1. Ambulance objects keep track of the patient picked up assigned at pickup and initialized to none
   2. Their next pickup time, initialized at 0 and changed to 10 to the 30 when the ambulance has a patient in it and recalculated after patient drop off
   3. Their next patient drop off time, initialized at 10 to the 30 and calculated at pickup, once again set to 10 to the 30 after drop off
7. The other object that we need is Hospitals. Each hospital keeps its own set of resources (servers) for each triage class, each hospital also can differ in the number of servers of each type that it has
   1. Each hospital also has different queues for the triage types
   2. Each hospital object has five attributes, distance from the scene, the number of servers they have for each class, and the queue size for each class
8. The first process in our model that I’m going to cover is travel times. Travel times from the location to the hospital are log normal and use speed and distance to calculate the mean and variance.
   1. The m and v in the equations for mu and sigma squared are the mean and variance of the normal distribution
   2. (read the first set of equations off the slide)
   3. For our simulation we based our log parameters on the distance, the mean being 0.025 times and the variation being 0.01 times the distance
   4. Up on the left here I’ve put the pdf of the lognormal distribution (read off the slide)
9. The second process that we need is expected patient survival probability which we can model as a shifted log logistic distribution based on the type of patient.
   1. (read the equation from the slide)
   2. The table shows the parameters we’re using for evaluating the expected survival probability
   3. Pen denotes penetrative wounds – in essence gunshot wounds
   4. The beta one from the exponential parameters are going to be used later as the “expected discount rate” during patient selection