Project 3 And Simulation

FIT 100

Simulation can be an effective technique for understanding the physical world. Though there is a wide range of simulation techniques, we recognize three: animation, synchronous simulation, discrete event simulation.

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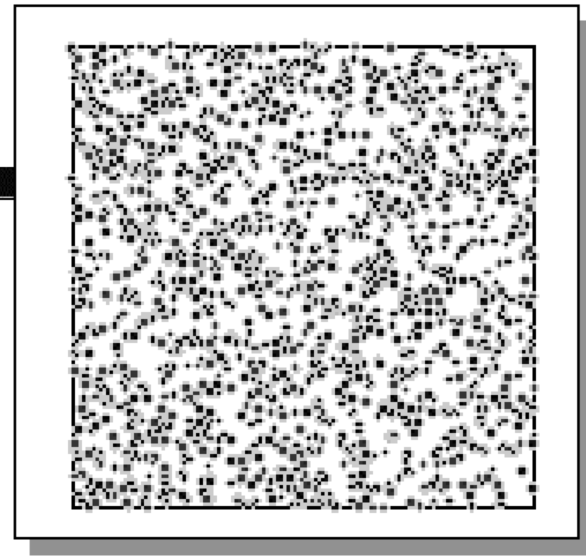
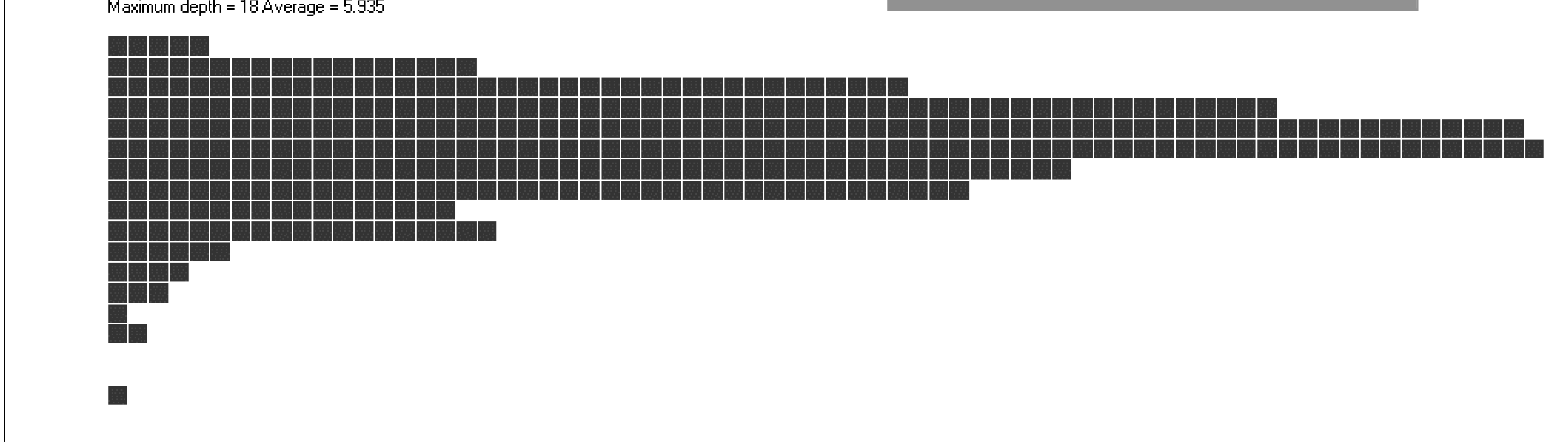
Project 3 ...

- ❖ Given the raindrop program embellish it and experiment





FIT 100 Tasks

- Draw drops (P)
- Analyze coarseness of model (E)
- Draw last drop in red (P)
- Explain observations (W)
- Check last dry point (P)
- Histogram depth (P)
- Explore the behavior (E)
- Improve the model (P)
- Explore improvement (E)
- Explain good/bad parts of raindrop model (W)

P = programming
E = experimentation
W = writing

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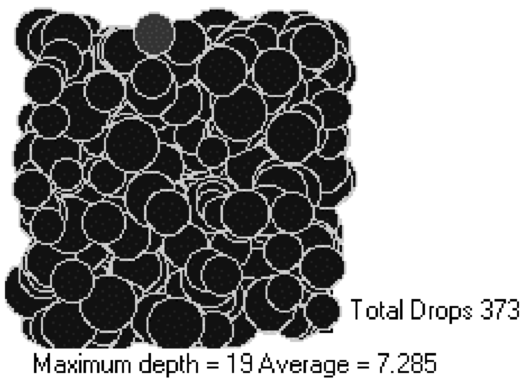
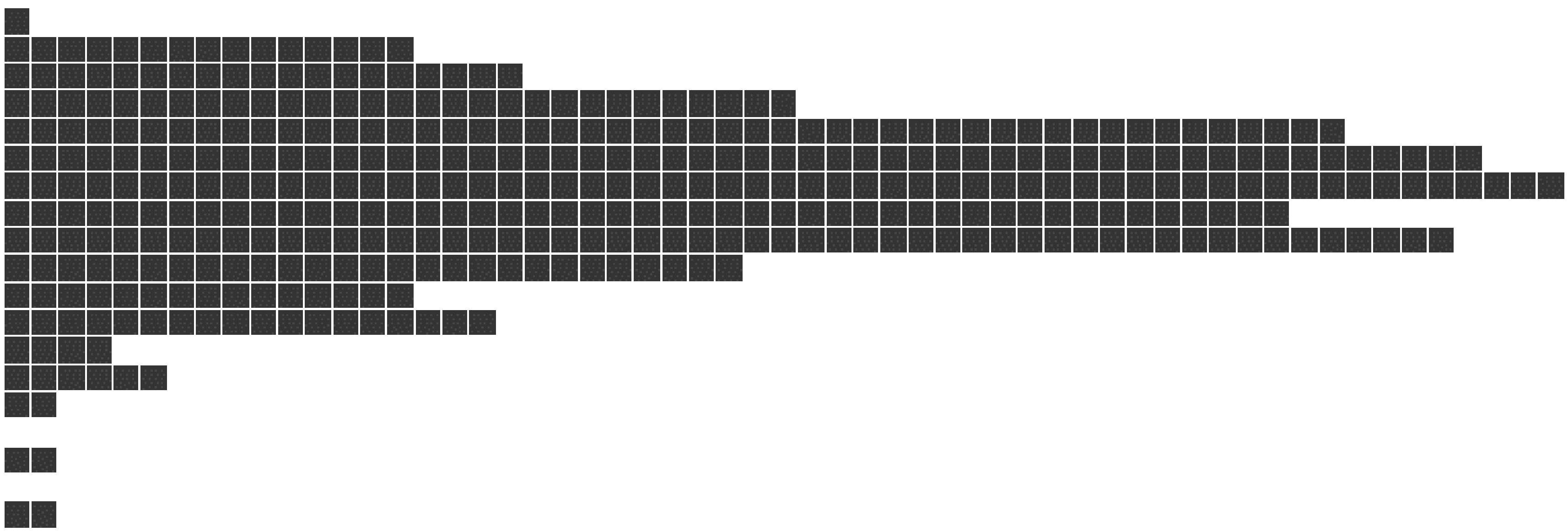
Figuring The Average



To figure the average depth of drops, multiply the number of boxes in a row *r* times *r*, add all those values together and divide by the total number of boxes:

((1x1) + (15x2) + (19x3) +…+ (2x19))/400



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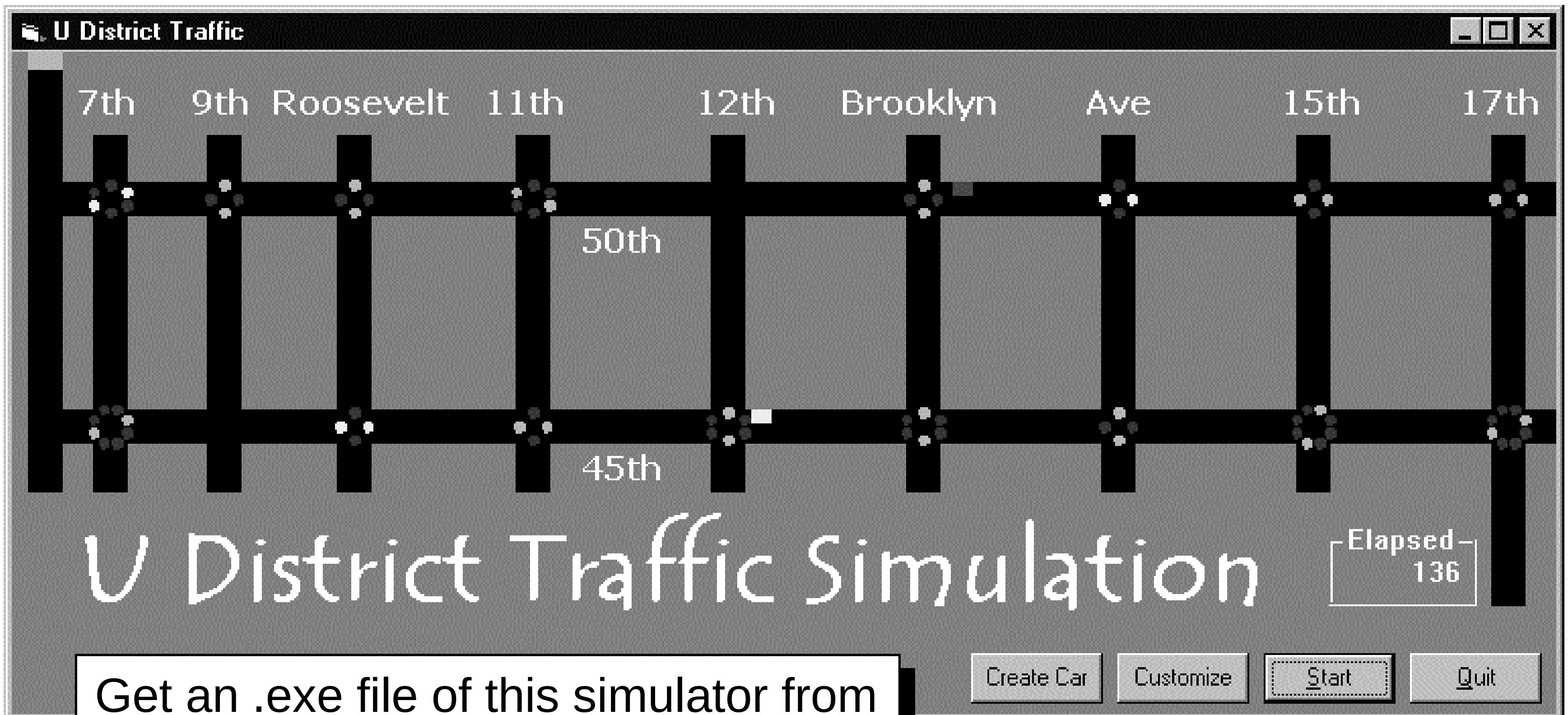
A Simulator

- A VB6 program to simulate traffic lights along 45th and 50th streets …which is the fastest route to I-5?



Get an .exe file of this simulator from CSE100-Sp99 file archive on WWW

FIT 100 Watch The Simulator Run

- Salient features
  - There are three different types of light configurations
  - Lights go through a standard protocol depending on their type … their different features are
    - Initial state and initial duration
    - Duration for green … it implies red
    - Duration for left turn green
  - Cars must follow traffic laws, i.e. stop on red
  - Cars move at a constant rate … start out instantaneously, stop instantaneously, corner instantaneously, have no speed variation, no traffic to respond to, no college students drifting out into the street, ...

> How many states for a “full” light?

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Animation

- Animation is a form of simulation in which the emphasis is placed on making the visual display of the system “accurate”
  - For example, people and animals in film animation have a “skeleton,” but it is not simulated bones or have correct physical properties … its mostly a reference point
- In Virtual Reality the degree of verisimilitude is usually limited by the need to run fast
- The U District Traffic Simulator is an animation

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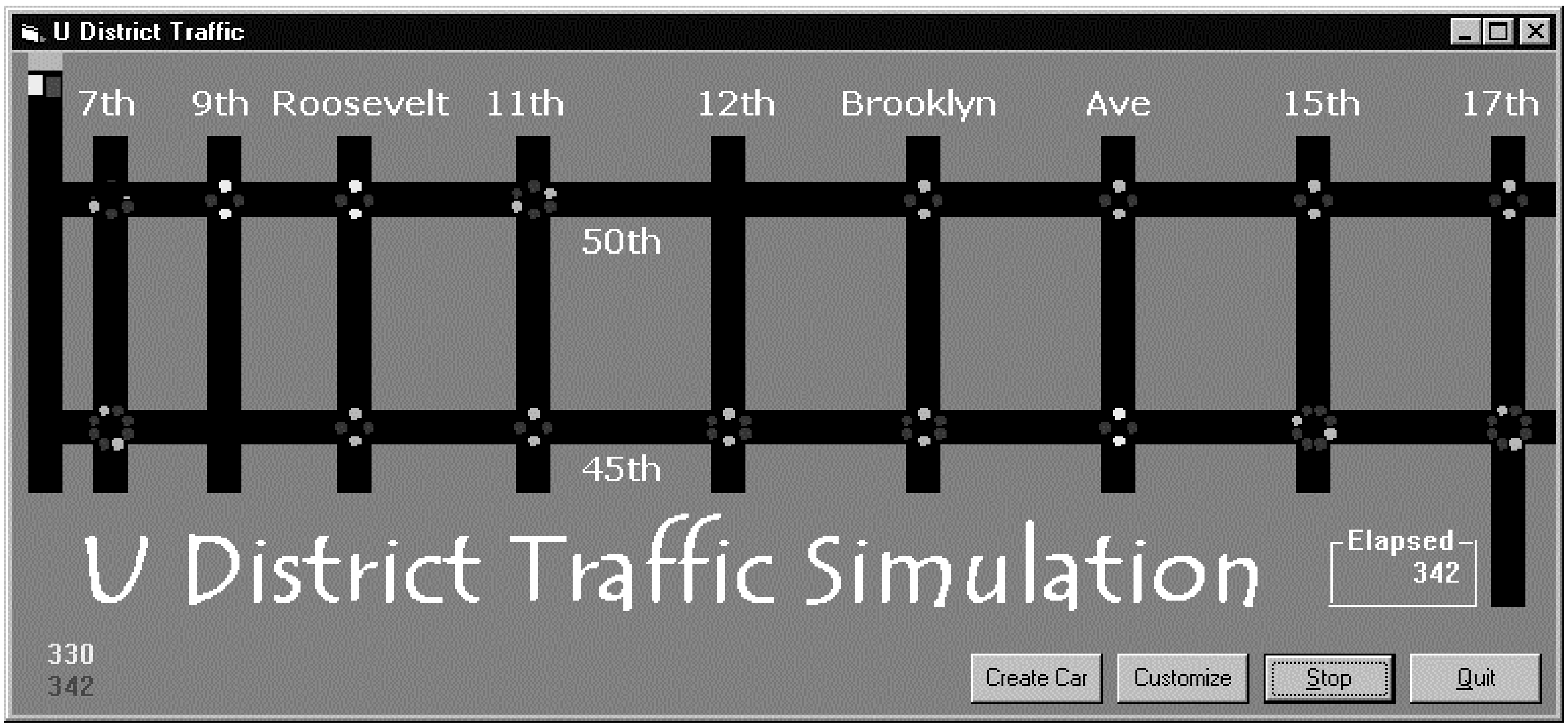
Messing With Time

- All simulators have a “clock” that represents global time
- In animations and in many other types of simulations, this time is advanced at regular intervals, as a physical clock would advance
- But there is no reason for the simulator to advance the clock according to physical time if there is not issue of animation

> For example, if traffic is being simulated and at a given time t all computation is completed and the computer is simply waiting for time to pass until t+200 ms arrives, then just skip waiting, advance the clock and begin the next simulation step

Unsafe At Any Speed

❖ When the timer is removed and the events are executed one after another, the result is exactly the same, but faster



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Synchronous Simulation

- In a synchronous simulation each of the simulated objects is updated with each (logical) clock tick even if there is no change … that is, all parts of the system are updated synchronously
- The U-District Traffic Simulator is a synchronous simulator since the state of each light and car is updated with each advancement of the clock
- Synchronous simulation is used for continuous simulations (wind over airplane wings, stars moving in a galaxy), and in other systems in which most elements change most of the time

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Discrete Event Simulation

- Rather than updating every part of a simulation on each clock tick, discrete event simulators keep a list of when each part of the simulation will change, and therefore needs to be updated
- This “event list” is sorted by time, earliest first
- Then, the simulator simply performs the operations...
  - Advance the clock to the time of the first element on the event list, and remove it
  - Perform that operation and update its state
  - Determine when it will next change, and if it has caused others things to change
  - Add them to the event list in their correct places

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Accuracy For The UDTS

- The properties of the lights in the UDTS are simply invented, but they could be determined by observation on 45th and 50th
- What facts are needed:
  - Check that type of light is correct
  - Determine the durations of each light
  - Establish the starting times relative to a base reference
- These values can then be used to initialize the simulation and customize the properties of the lights