UNITED STATES MILITARY ACADEMY

PROJECT 4

CS488: LANG-BASED SIMULATION MODELING

SECTION C1

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Code Changes

To record the number of successful and total trips, and the number of detonated hazards and total hazards I created a new record with type `Completion_Data_Type`. The record simply contains four `Natural` fields corresponding to the information we wish to track. In the `Simulation_-State_Type`, I added a new field entitled `Completion_Data` to allow easy access for updates. The logical place to update such information is in the polymorphic procedure `Handle` which operates on `Friend_Movement_Types` because `Handle` checks for hazard collisions and completed trips. So after the check for `Hazard_ID > 0` (a hazard collision occured) and the check to `Friend_Is_Hurt`, we call the convience procedure, `Log_Unsuccessful_Trip` with the current state to increment the number of total trips and the number of detonated hazard. When a trip is complete, we use the convenience procedure `Log_Successful_Trip` to increment the number of successful trips and total trips. Finally, we need to track the total number of hazards, which occurs in `Handle` for `Hazard_Emplacement_Type`. We use the convience procedure `Log_Hazard_Emplacment` to increment the number of total hazards and call this in the opening lines of `Handle`

To display the data I used a simple CSV like format. To calculate the trip and hazard success ratios, I created simple functions to handle the type conversions and division. To display the resulting reals I created a `Print_Real` procedure to put reals to the screen without the exponent and with four digits following the decimal.

Impact of Point Estimators on Run Length

As the time increases, the friend success ratio decrease. In contrast, as time increases, the hazard success ratio increases.

Change in the confidence half-interval over the change in number of runs

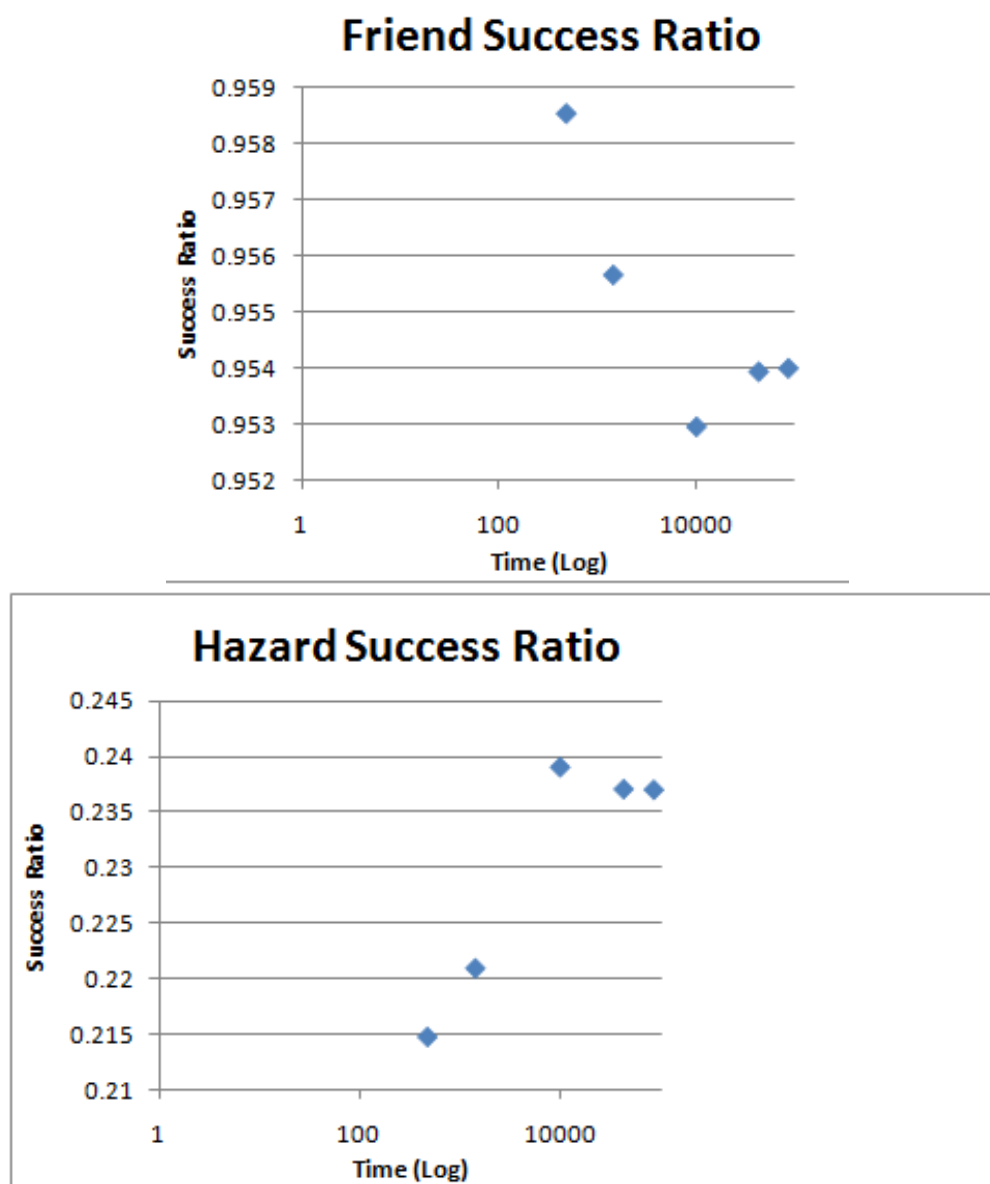As expected the confidence interval approaches 100% as the number of runs increases.

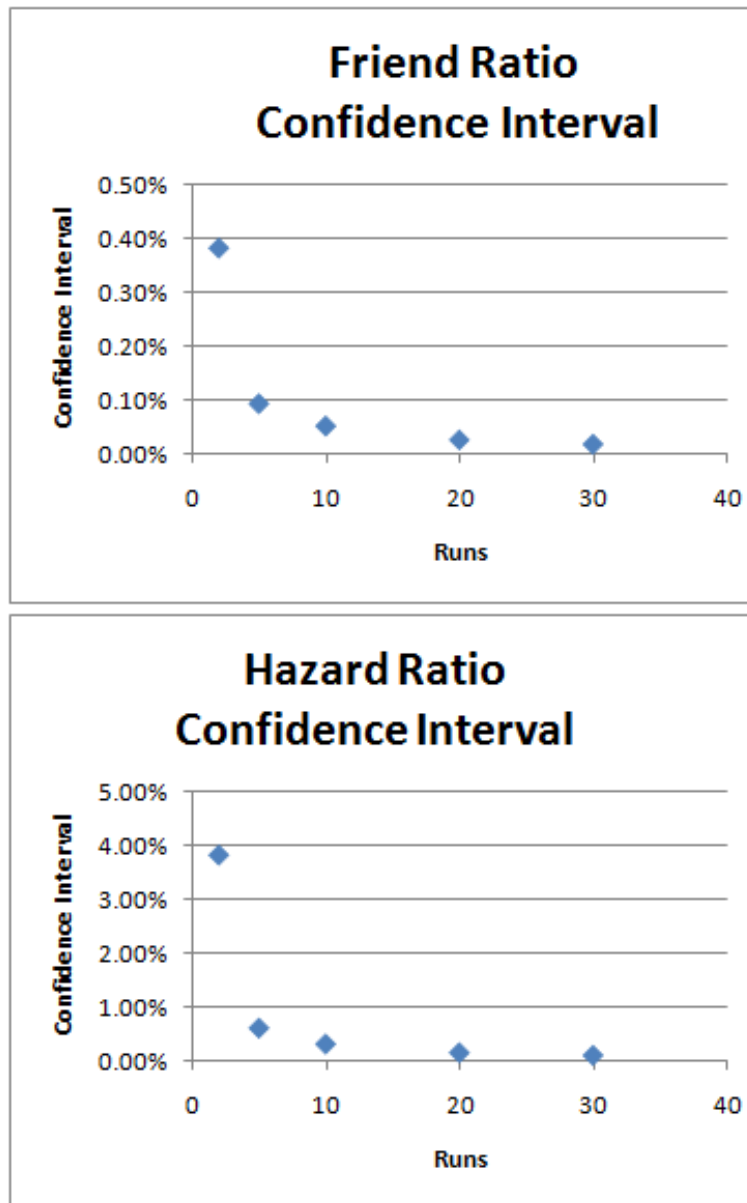Figure 1: Success Ratios with different length runs

Figure 2: Confidence Intervals with different length runs

Why are the number of hazards placed unchanging over independent replications?

Because hazard emplacment follows an exponential distribution which describes events whose interarrival times are completely random and independent.

How many runs are truly different between 2 runs and 30 runs in the current simulator?

The runs are very similar, with only minor variations in the friend and hazard success ratios.

Output Data

All data is contained within runData.xlsx.

Notes

CDT Monte Hoover, discussion with the author, 12 May 2010, West Point, NY. Monte provided an example of how to use excel functions to calculate a confidence interval using the Student-t distribution. He provided his excel project file, which I used almost verbatim to develop my own analysis. The analysis for the second sheet in runData.xlsx is based almost entirely on Monte's work.