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# Applying Crime Mapping and Analysis Techniques to Forecast Insurgent Attacks in Iraq

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# What is the problem?

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- We want to forecast where and when the next insurgent attack will occur

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# Why is this problem important?

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- Lives are at stake
- Prioritization and allocation of scarce resources

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# What have we done to address this problem?

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- Apply crime mapping and analysis techniques to forecast the location and timing of future insurgent attacks

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# Background

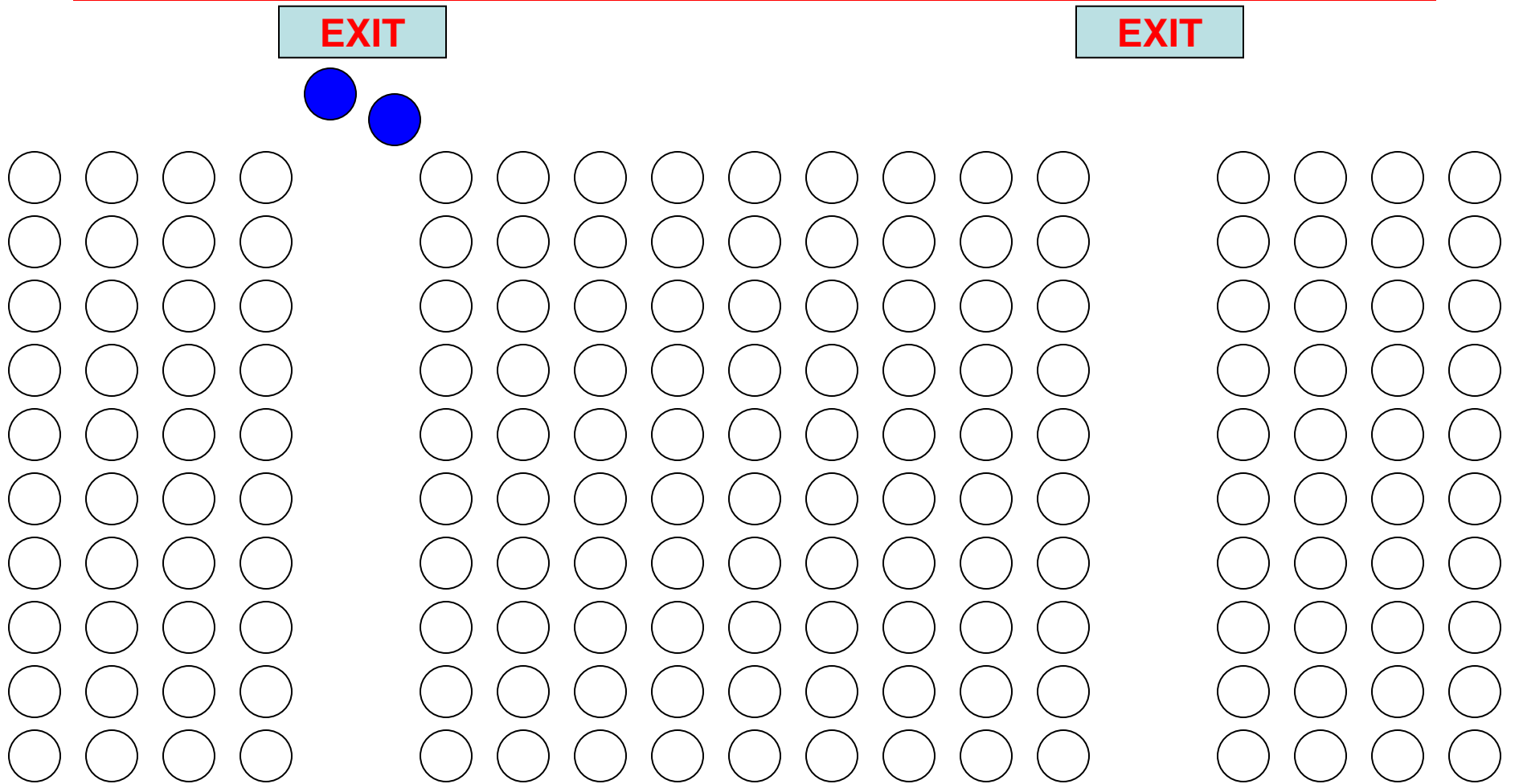
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- Insurgent activity in Iraq parallels serial crime rather than traditional military operations
- Fundamental Concept: There is no truly random behavior
- A serial criminal (or insurgent) cannot fully randomize his attacks
- A serial criminal (or insurgent) is human; he uses a logical decision model to make his choices
- We simply have to figure out his decision model...

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# A Decision Model Example: Finding a Seat in a Movie Theater



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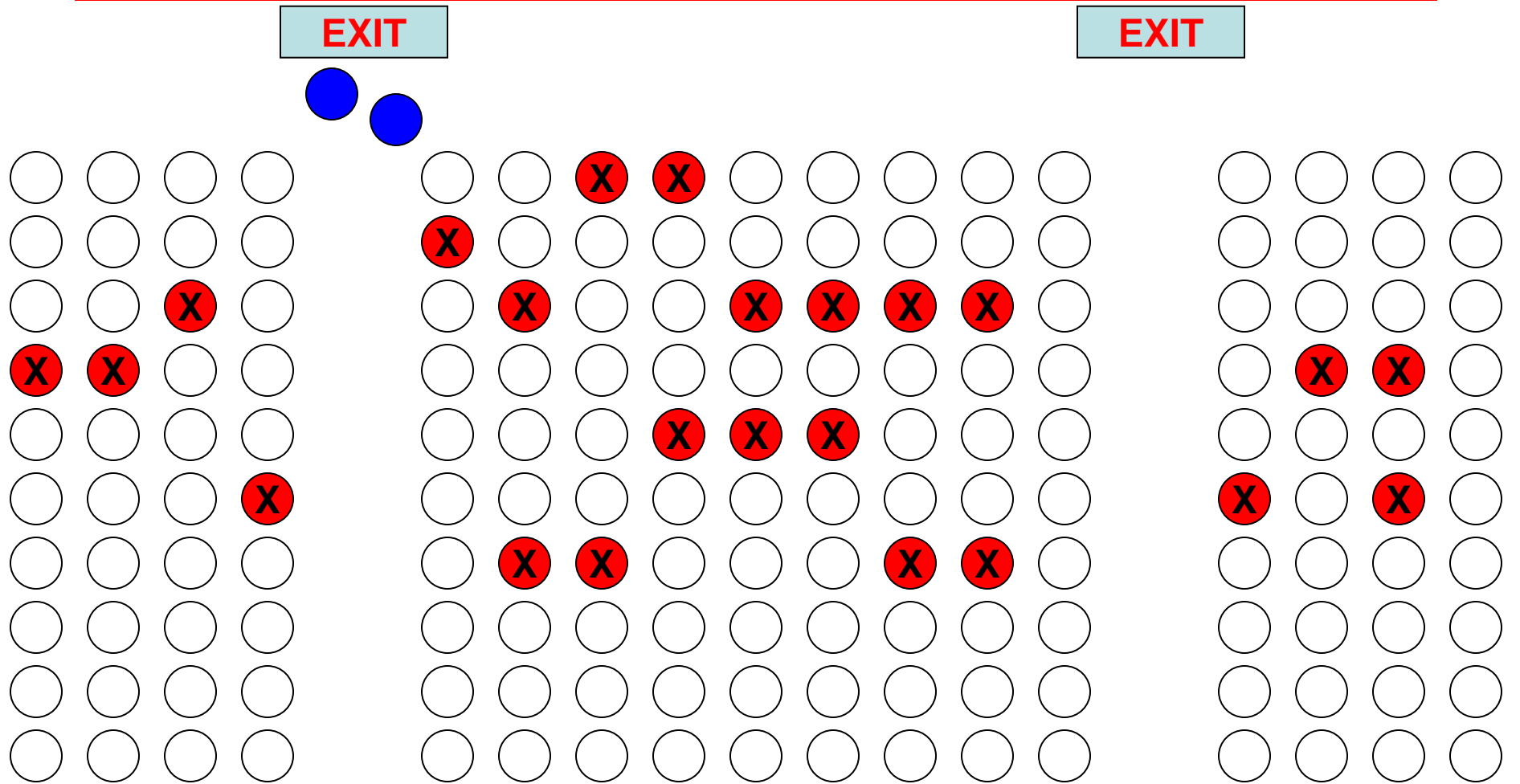
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# Rule #1: Can't Sit on Anyone Else



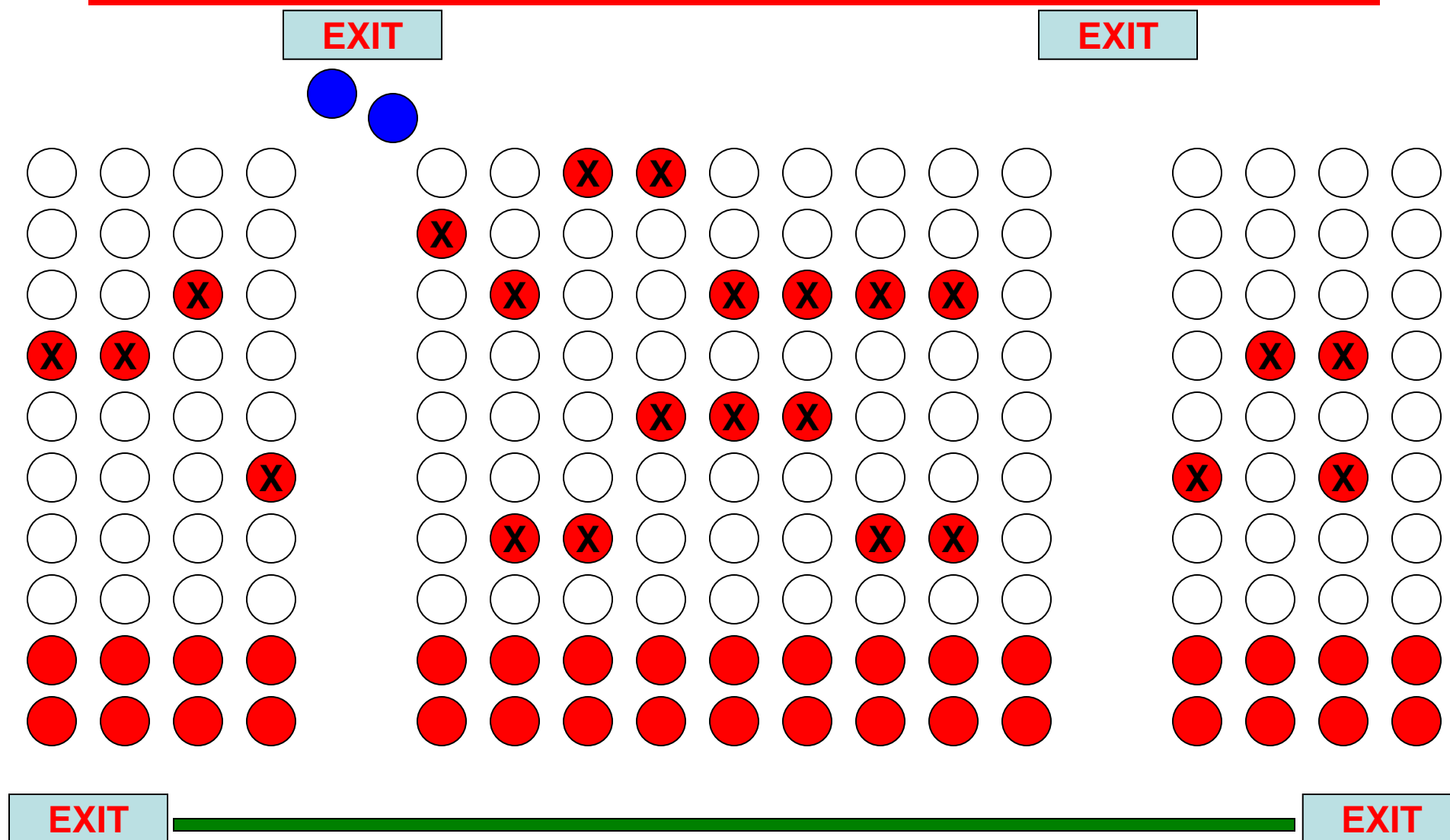
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# Rule #2: Don't Like to Sit in the Front



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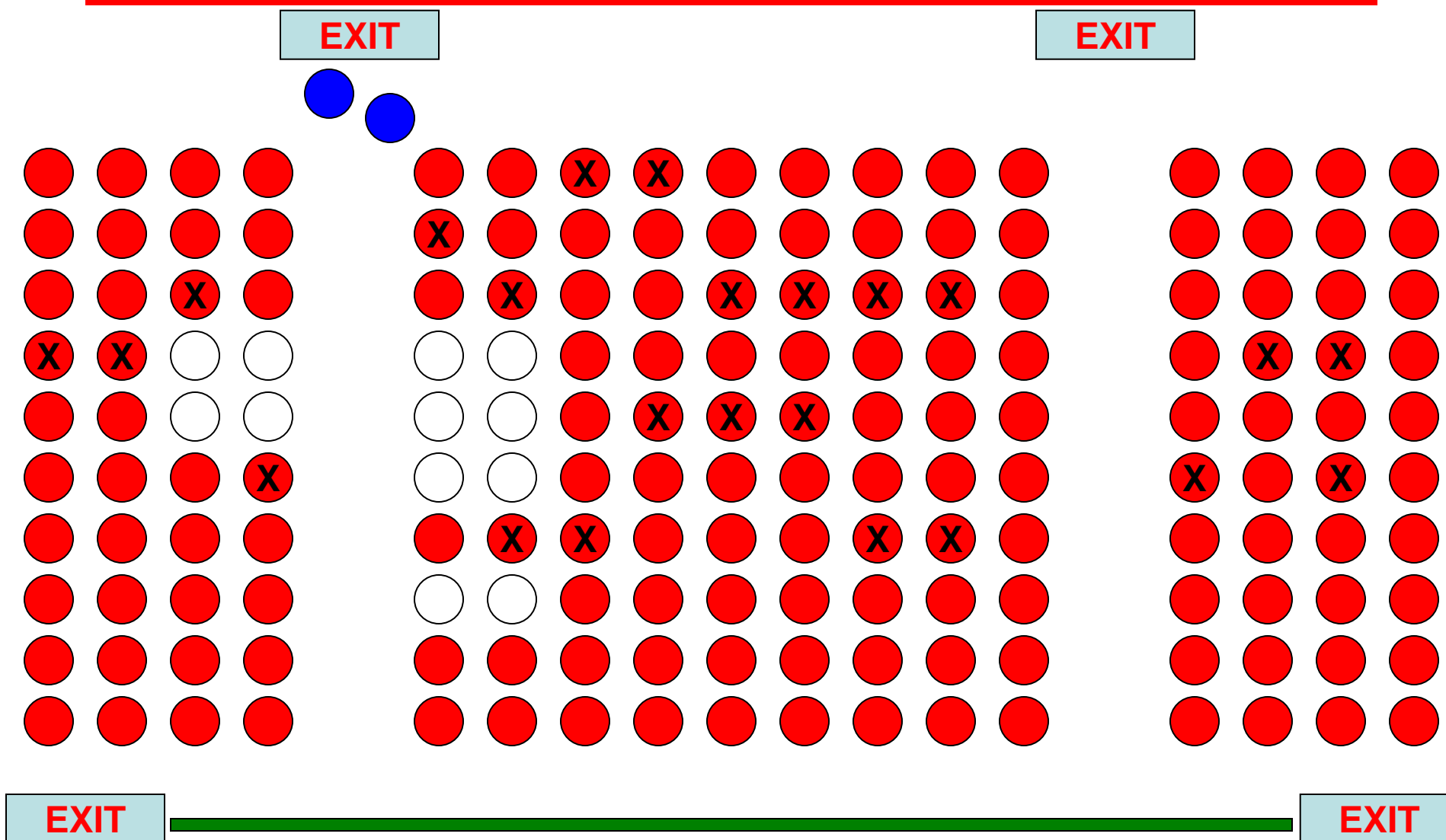






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# Rule #7: Need Two Seats Together

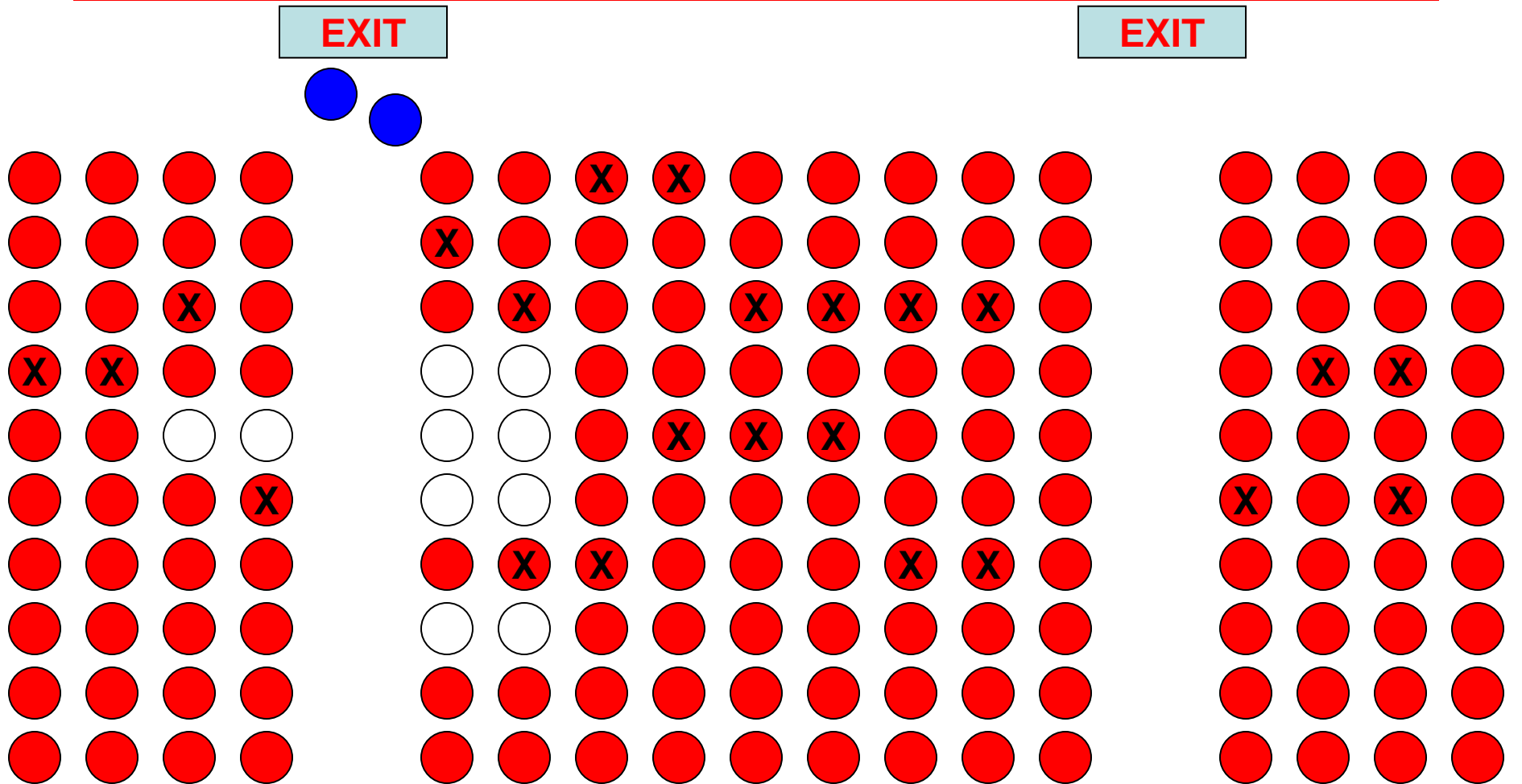


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# Rule #8: Need Buffer Space



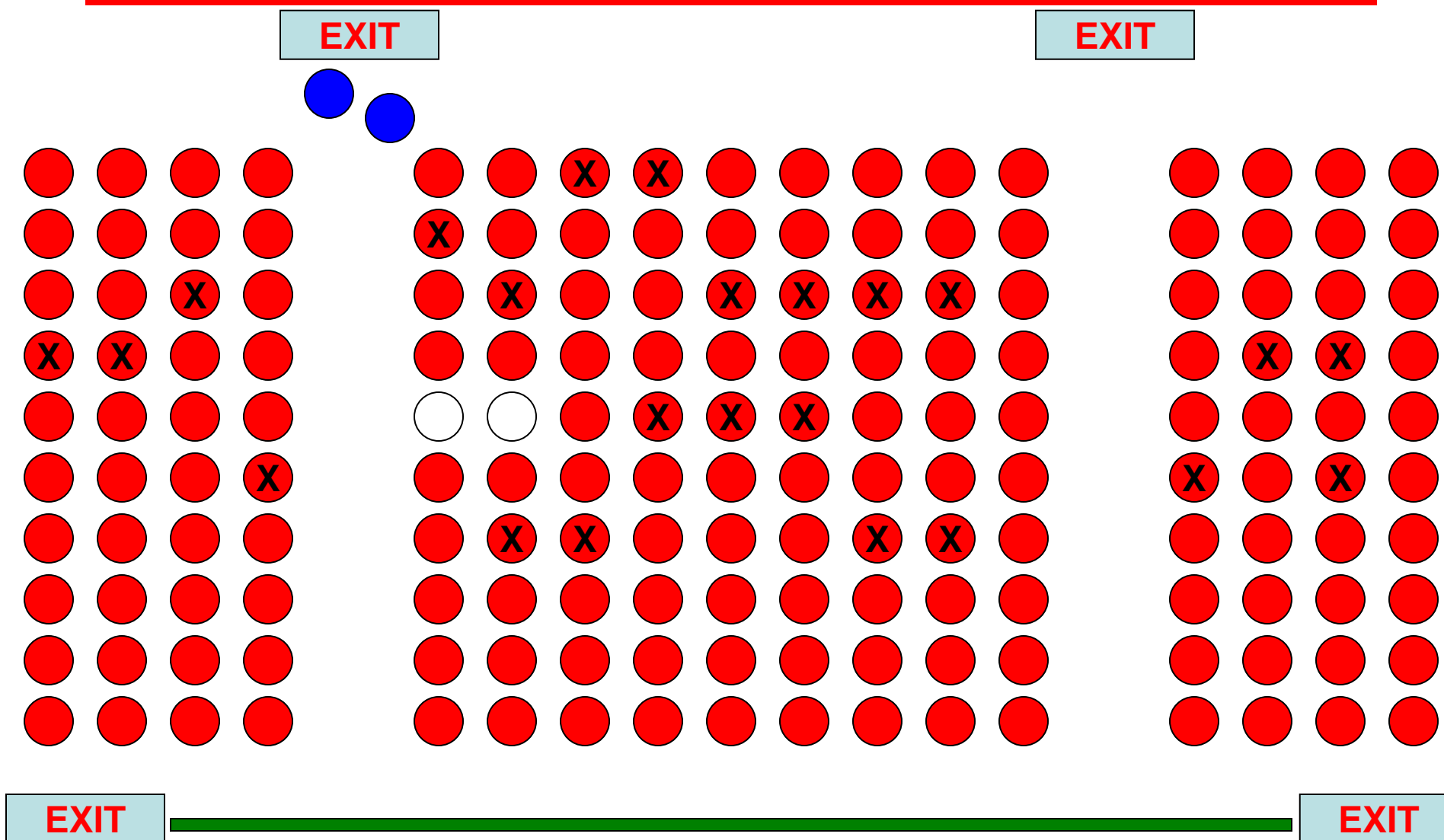
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# Rule #9: Nobody in Front or Behind



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# Methodology

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1. Identify series of insurgent attacks that are logically linked to the same insurgent or insurgent cell
2. Analyze each series for spatial/temporal trends and patterns – attempt to determine the rules used in the decision model
3. Make a forecast

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# Identifying the Series

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- Most difficult part of the process
- Modus Operandi – necessary to commit the act
- Signature Behavior – not necessary; unique behavior
- Spatial and temporal criteria often work well

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# Forecasting From a Series

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- Static vs. Dynamic Factors
- Dozens of techniques used by crime analysts
- Most useful techniques for forecasting
  - Tempograms
  - Temporal Trends
    - Day of Week
    - Hour of Day
    - Temporal Topology
  - Event Sequencing and Animation

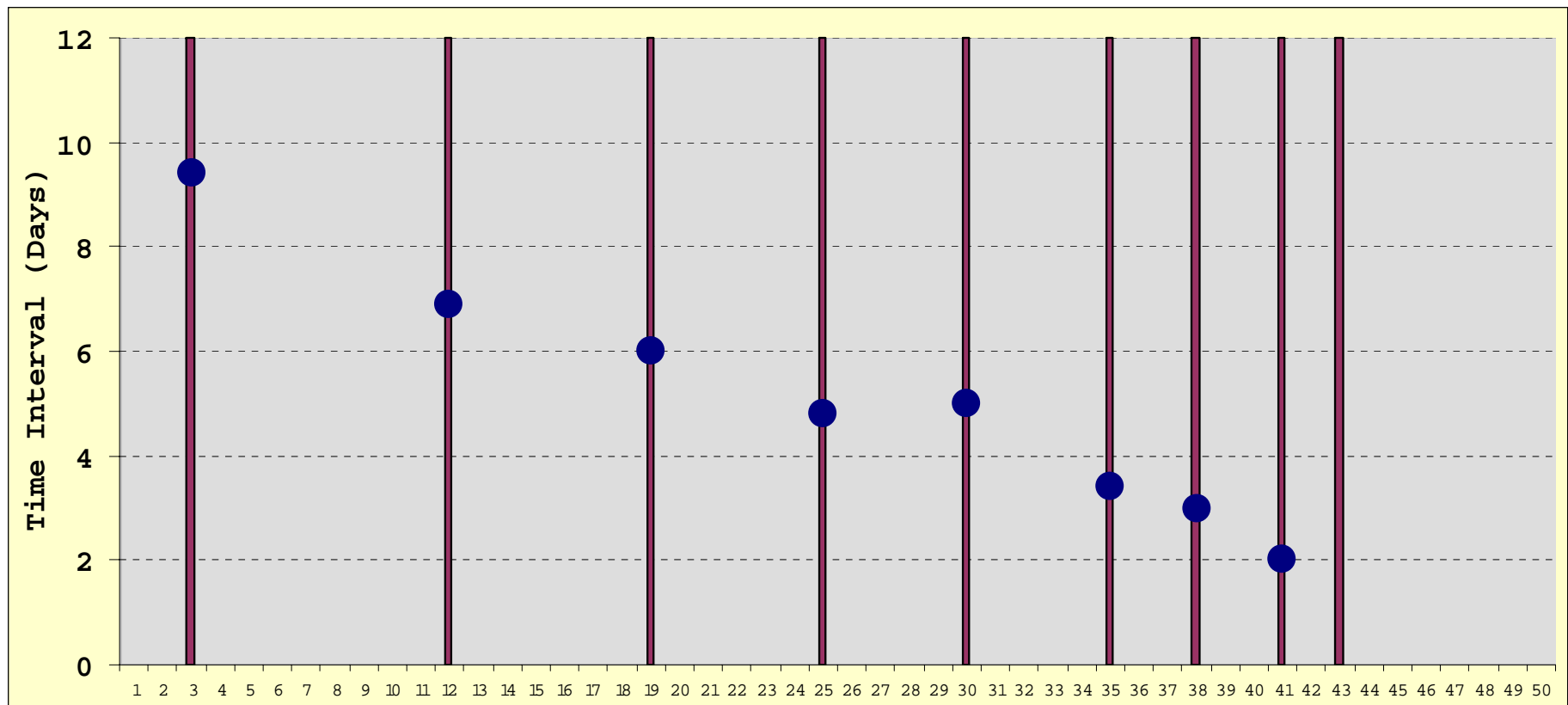
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# Tempograms

- Plot of the time between events



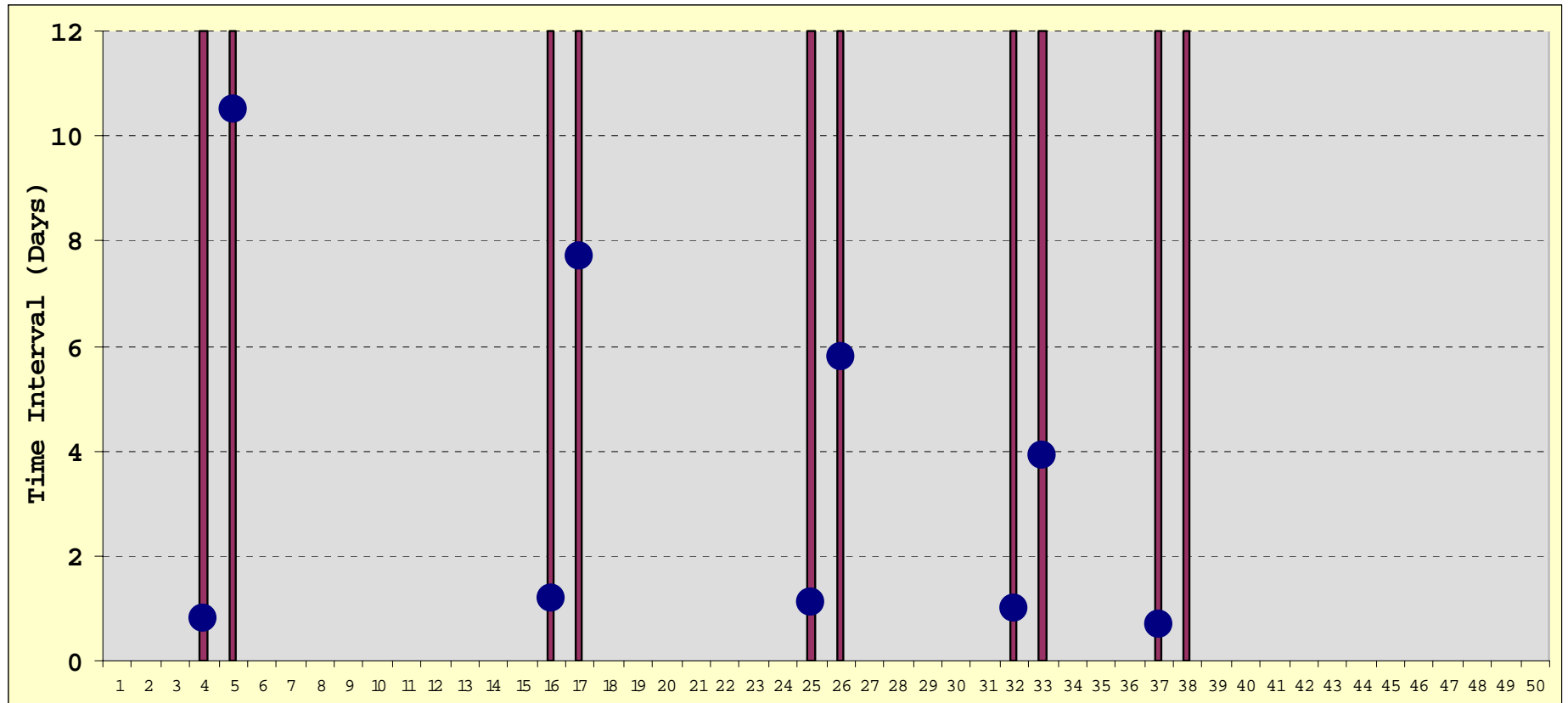
- Decreasing time between events = “accelerating tempo”

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# Tempograms



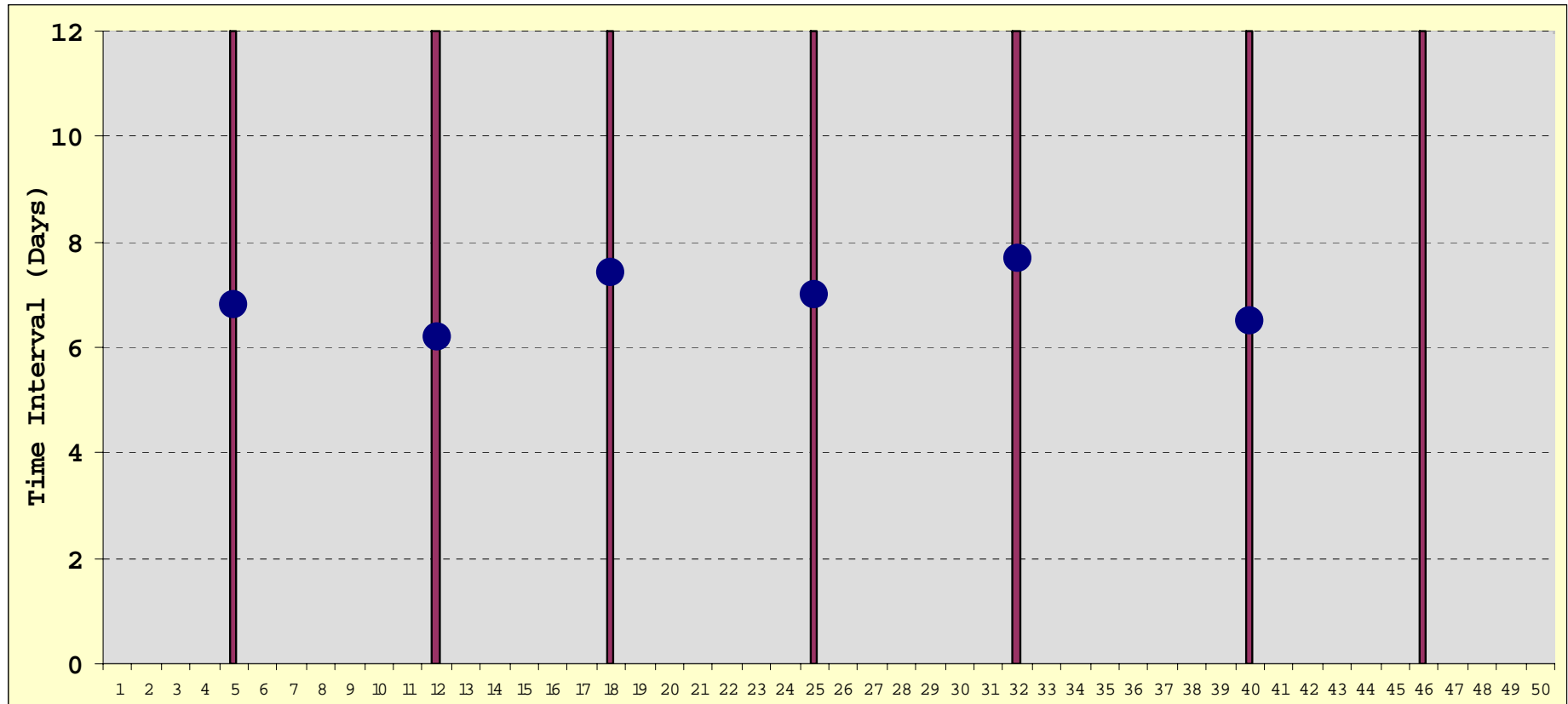
- Clustered distribution – events come in sets of two
- Accelerated tempo between sets

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# Tempograms



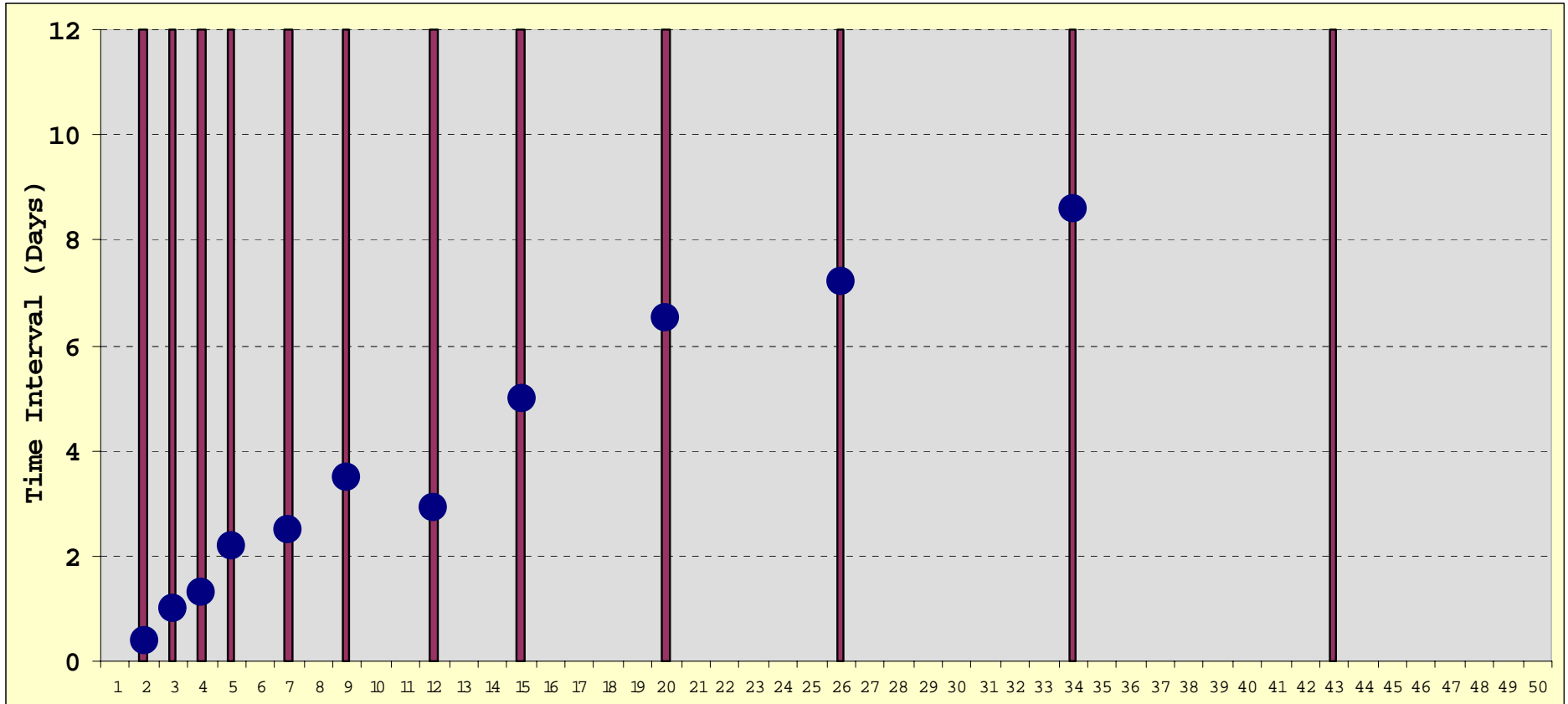
- Uniform time interval between events (in this case, suggests a weekly schedule)

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# Tempograms



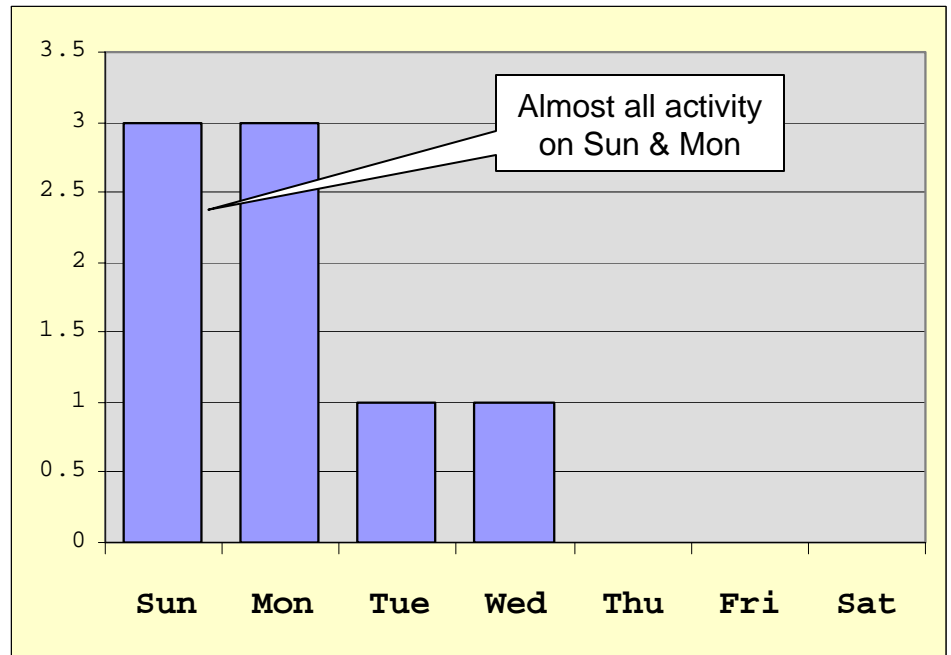
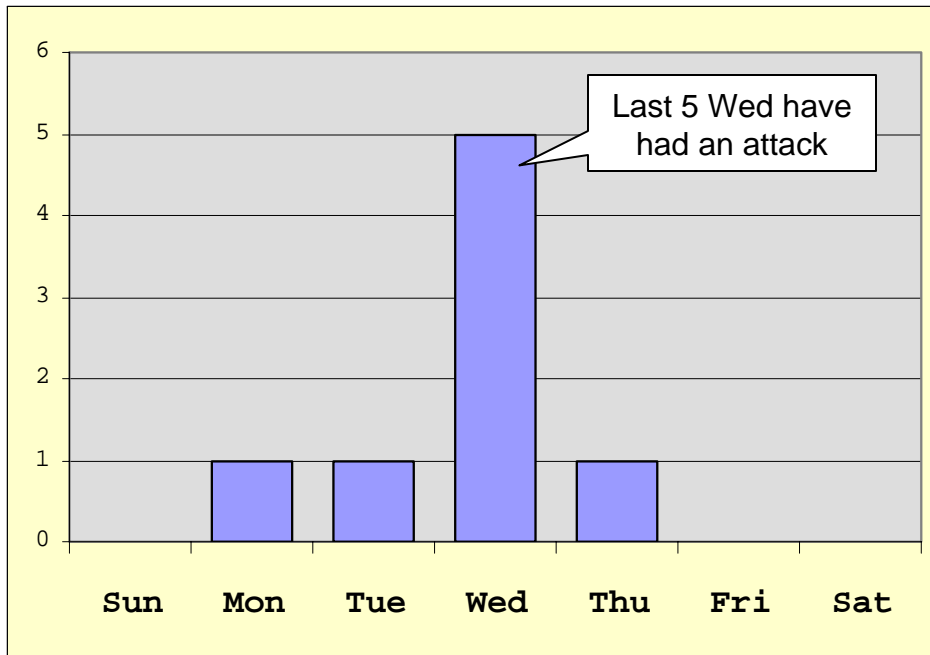
- Decelerating tempo

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# Temporal Trends – Day of Week

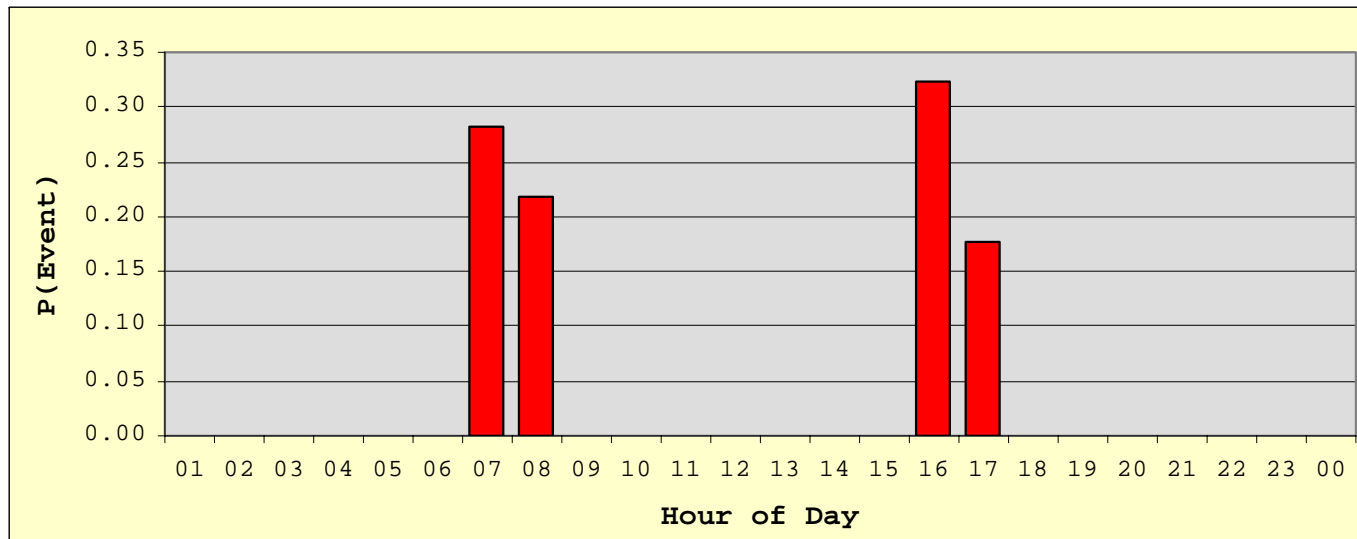
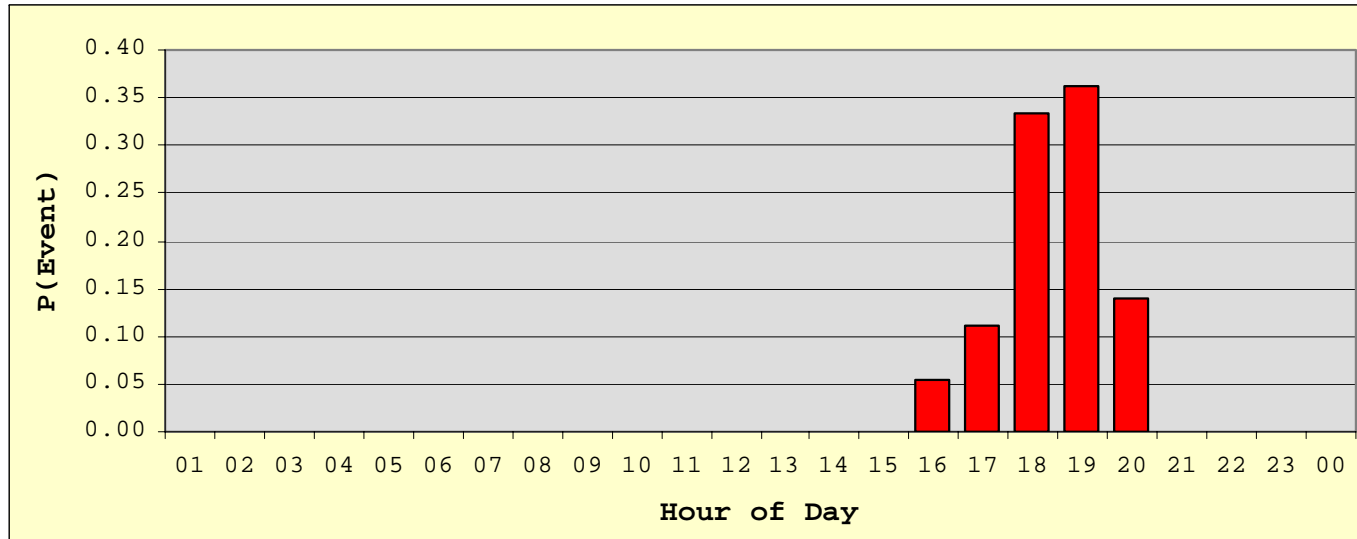


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# Temporal Trends – Hour of Day



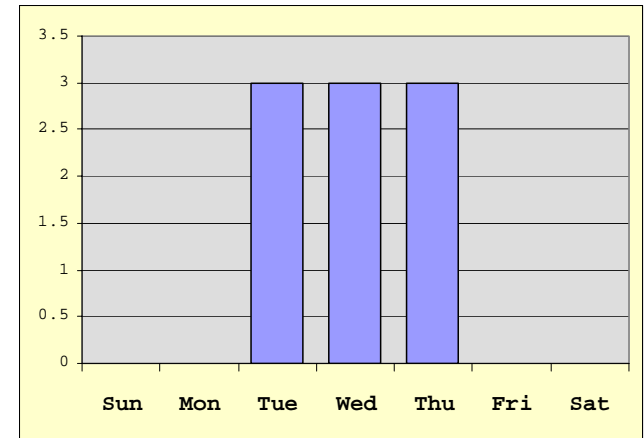
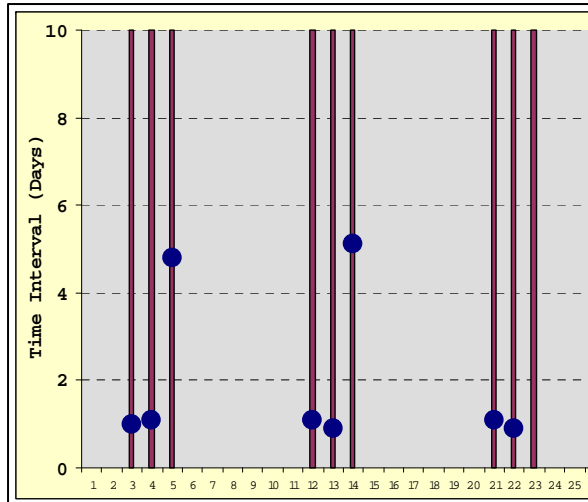
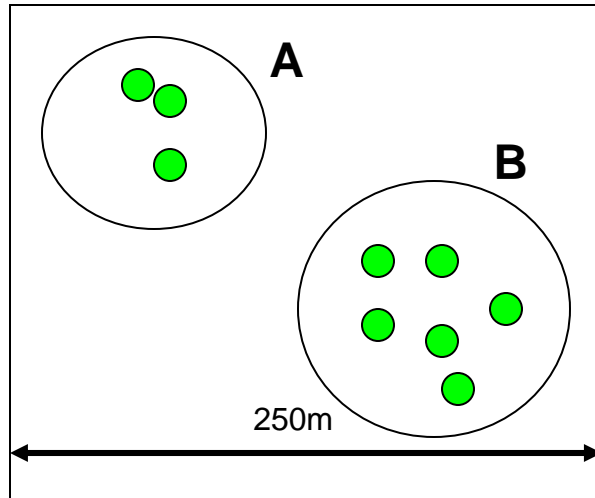






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# Case Study



- Pattern of 3 events in quick succession, followed by a break
- First 2 events in set in area B; last event in set in area A
- Uniform tempo between sets of events – one week
- All attacks occurred on Tue/Wed/Thurs
- All attacks between 1600 and 1900

**Forecast: Expect three events in quick succession (Tue/Wed/Thurs) between 1600-1900; first two in area B, third in area A.**

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# Operational Impact

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- Our forecasts were actionable
- ~30% of forecasts were successful
- ~2 successful forecasts each day
- Informed the prioritization and allocation of scarce resources
- Saved lives and prevented injuries to our troops

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# Questions

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