Project 5: Time

TOTAL: 10pts

GOAL

Analyze ***when*** the next event in a crime series will occur.

Step 0: PREPARATION

- This is a continuation of tactical crime analysis. But what is tactical crime analysis?
- This project specifically focuses on temporal crime analysis. But what is temporal crime analysis?

Step 1: DATA

1. Begin with your active crime series data from Project 4.
2. Copy your series to a new/separate sheet.
3. ***Delete the latest/most recent event*** (that's the event you'll eventually be predicting).

Done.

Step 2: METHODS

The steps here and in the next section are based on formulas in Excel. Some formulas will be slightly different in Google Sheets, and some of the columns will potentially need to be adjusted for your data.

1. Add a "T coordinate" to your events
    a. The first event has a value of zero.
    b. All subsequent events are based on the number of hours or days since Event 1.
        i. =F3-F2
            1. Where column G is "Date"
2. Add a "Day of Week" column
    a. =TEXT(G2,"dddd")
        i. Where column G is "Date"
3. Add a "Month" column
    a. =TEXT(F2,"mmmm")
        i. Where column F is "Date"

4. Add an "Interval" column
    a. Starting in row 3, =F3-F2
        i. Where column F is "Date"
5. If your data has time, make sure you have an "Hour" field (get rid of leading zeros). Also, add an "Day" column.
    a. Determine morning/afternoon/night splits in your data
    b. For example
        i. =IF(H2>17,"Night",(IF(H2<11,"Morning","Afternoon")))
            1. Where column H is "Hour"
            2. Using this formula, mornings are before 11:00 AM, and nights are after 5:00 PM. Adjust accordingly.
6. Do a similar process for Weekdays vs Weekends
    a. =IF(OR(C2="Sunday",C2="Saturday"),"Weekend","Weekday")
7. That's it.

Step 3: CALCULATIONS

For the columns added to your data:

1. Manually color-code (***Day of Week***, ***Weekend***)
    a. Identify *lags*, which are non-obvious patterns/rotations in activity
        i. For example, if the most recent event occurred at "Night", look at all the prior nighttime events. What type of event occurred after each of those?
2. Use pivot tables (***Hour***, ***Day of Week***, ***Month***, ***Day***)
    a. Generate counts and percentages of activity
    b. If you have a low event count, you can manually count/calculate these too
    c. This also includes cross tabulations of two nominal variables (Day of Week, Hour of Day, etc.)
3. Use conditional formatting (***Hour***, ***Interval***)
    a. Find changes over time
    b. Compare the most recent event to similar prior events - what typically happens next?
4. Calculate the mean, standard deviation, and skewness (***Hour, Interval***)
    a. "Mean" uses the =AVERAGE() function in Excel
    b. "Standard Deviation" uses the =STDEV() function in Excel
    c. "Skew" uses the =SKEW() function in Excel
        i. A skewness of less than -2.0 or greater than +2.0 means your data is significantly skewed, and you generally shouldn't trust the mean and standard deviation
    d. If your data is a normal distribution, calculate the "Max" (Mean + Standard Deviation) and the "Min" (Mean - Standard Deviation) to determine the 95% confidence intervals of ***past activity***.
5. Calculate percentage change as necessary (***Interval***)
    a. =((E4-E3)/E3)*100
        i. This normalizes the values and makes it easier to observe patterns
        ii. After calculating, consider conditional formatting or graphing
6. Calculate correlations as necessary
    a. Identify two numeric columns of interest
        i. Hour, Interval, Victim Count, Property Value, Centroid*, Movement*, etc
        ii. "Correlation" uses the =CORREL() function in Excel

1. =CORREL(H2:H14,O2:O14)
2. Make sure both columns have the same amount of data
    a. Evaluating the ***direction*** and the ***strength*** of any relationship

HERE IS THE EXAMPLE EXCEL WORKBOOK FROM CLASS ON 02 APRIL 2025

Step 4: VISUALS

- Create basic graphs in Excel
    - Insert -> 2d line -> line with markers -> select data -> choose your column
        - Right-click on the points to display a trend line
    - Visually scan for patterns of time
        - For example, does the 'Interval' stay consistent?
        - ***If you notice sudden changes, recalculate your stats since that change***
            - This is completely acceptable and demonstrates an awareness of the offender's dynamic patterns over time.
                - CAN: ignore/remove early events that operate at a different tempo. The events are still part of the series, but their pattern has gone fallow
                - CAN NOT: ignore/remove events in the middle or end of the series; you can't pick and choose what to analyze.

HERE IS A COPY OF THE FILE WE BUILT IN CLASS ON 09 APRIL 2025

Step 5: ANALYSIS

For starters, think of your analysis as inputs to this template. For this project focus on slides 6 and 7.

Next, there are several key concepts to understand:

- Temporal crime prediction occurs at the macro and micro level
    - Macro: Date(s)/Months
    - Micro: Time of Day/Day of Week
- Temporal crime prediction is an interdependent facet of next-event prediction. Trends and patterns for behavior and space influence where the next crime may occur.
- As you progress thru this project, with each calculation ask yourself how that analytic informs on the next event. Literally ask yourself "when is the next event most likely to occur?"

Then, conduct quantitative analysis on the Hour, T Coordinate, and Interval
    - Stats, graphs, conditional formatting, correlations
- Conduct qualitative analysis of the Day of Week, Month, and Day
    - Color-coding, pivot tables
- Similar to Prediction 1, fill in the next row of events with your prediction
    - Include your assessments for crime, gender, age, centroid, and sequence in this row to understand correlations
- Identify the date, day of week, and time of day for the next event in your series.

- Be as precise as possible, but consider ranges of activity.

Be precise in your prediction and analysis. Try to avoid words such as "many" and "most;" instead use specifics ("...8 of 10 attacks occur," for example).

Keep this in mind: your analysis should inform law enforcement on a specific pattern of crimes. There is going to be unique, exploitable, identifying characteristics about that pattern that creates actionable opportunities for law enforcement to do something about it. When writing up your analysis, consider this perspective, and focus on the details that are most relevant.

Also, write your analysis in 'real-time,' assuming that the crime pattern is still active/on-going. Basically, treat the bulletin as if it were the day after the most recent attack.

SUBMISSION

Once your analysis is complete, please submit your project via Canvas. Your submission should be a document - either as PDF, Word, Pages, or Google Doc, accompanied with an Excel Workbook or Google Sheet of your data and visuals.

GRADES

- **Part I: Series Analysis (6pts)**
  - Provide four analytic findings (**1.5pts each**)
  - Each finding should be 3+ sentences describing temporal patterns in the event points.
    - Specifically use, at a minimum, the "**interval**" and "**day of week**" fields in at least one of the findings each.
    - Each finding should discuss how the measure/calculation further informs on the predictability of when the next event will occur
- **Part II: Prediction (1pt)**
  - Provide 2-3 sentences describing *when* the next event in this series is likely to occur. Be as precise as possible. This prediction should be the natural evolution of your analytic findings.
- **Part III: Visuals (2pts)**
    - Include at least two *relevant* graphs of *either* (**1pt each**):
      - Events per month
      - Events per year
      - ***Events per day of week***
      - ***Interval***
      - Hour of day
- **Part IV: Data (1pt)**
  - Provide a table of your events. This can be a .CSV, .XLSX, or Google Sheet (**1pt**)
    - Include any additional columns, tabs, or calculations created

Please email me with any questions.