



Homework #5

Hail and Tornadoes Weather Problem

Background Information

Mankind with all of its inventions and weapons has the false belief that it is in control of the environment. All too often the weather delivers a reminder that we are not invincible.

Since the 1990s, the number of damaging storms each year has increased significantly. Is this increase “normal” or an indication of a more serious problem? We will examine two types of severe weather common to our region, hailstorms and tornadoes, to get an indication of weather trends.



Problem Statement

In this assignment, students will analyze hailstorm and tornado trends in Ohio, Pennsylvania, and West Virginia as well as tornado frequencies throughout the United States. From this data, they will chart actual frequencies over time and theorize on weather conditions and their relationship to geography.

Instructions

IMPORTANT: This assignment requires the Windows version of Microsoft 365. macOS users can access a ready-to-use version through Windows Virtual Desktop by following the instructions at <https://cs101.wvu.edu/wvd>.

IMPORTANT: Complete the steps below in the order they are given. Completing the steps out of order may complicate the assignment or result in an incorrect result.

1. Download and extract the provided Data Files ZIP file. It contains the following files for use in this assignment:
 - a. **hail.xml** – Data on hailstorms in the United States from 1970 to 2023 [1].

Table: <i>Hail</i>		
Field Name	Type	Description
HailID	Number	Primary key. Uniquely identifies each hailstorm.
StormDate	Date/Time	Date of hailstorm.
StateAbbrv	Short Text	Postal abbreviation of state where hailstorm occurred.
HailSize	Number	Size (diameter) of hail.

- b. **states.xml** – Listing of states and their postal abbreviations.

Table: <i>States</i>		
Field Name	Type	Description
StateAbbrv	Short Text	Primary key. Postal abbreviation of the state.
StateName	Short Text	Full name of the state



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- c. **tornadoes.xml** – Data on tornadoes in the United States from 1970 to 2023 with a minimum distance traveled of 0.01 miles [1].

Table: <i>Tornadoes</i>		
Field Name	Type	Description
TornadoID	Number	Primary key. Uniquely identifies each tornado.
StormDate	Date/Time	Date of tornado.
StateAbbrev	Short Text	Postal abbreviation of state where tornado occurred.
FujitaScale	Short Text	Fujita (F) or Enhanced Fujita (EF) rating of tornado.
MilesTraveled	Number	Distance traveled by tornado.
Deaths	Number	Number of deaths from tornado.
Injuries	Number	Number of injuries from tornado.

- d. **tornadoes.rtf** – Report text file to format in Word.
- e. **tornado.png** – Image of a tornado for use in PowerPoint.

Microsoft Access Portion

- Create a new Microsoft Access database named **hw5_htwp_lastname_firstname.accdb**.
- Import the following items into the database:
 - hail.xml** file – Import structure and data into a new table.
 - states.xml** file – Import structure and data into a new table.
 - tornadoes.xml** file – Import structure and data into a new table.
- Create the appropriate relationship for the following tables. Enforce referential integrity, but do not enable cascade updates or cascade deletes.
 - States* and *Tornadoes*
 - States* and *Hail*
- Create separate queries to provide the information requested below. Name each query after the step in which it appears (e.g., name the query in Step 5a as *Query5a*).

HINT: Run your queries to test them. Make sure that they display all and only the records that you would expect to appear.



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- a. Create a query to display statistics on each tornado. List the date, state name, miles traveled, number of deaths, and number of injuries. Also, include a field to calculate the number of injuries and deaths per mile traveled.

You can calculate the number of injuries and deaths per mile using the formula:

$$\frac{([Tornadoes.Injuries] + [Tornadoes.Deaths])}{[Tornadoes.MilesTraveled]}$$

Format the calculated field as a fixed-type number with 2 decimal places. Sort by date and then by state name, both in ascending order.

HINT: This query will show 60,345 records and 6 fields.

- b. We wish to calculate statistics on hailstorms. Create a query listing, for each state name, the average hail size and number of hailstorms.

Only include records for Ohio, Pennsylvania, and West Virginia.

Format the average hail size as a fixed-type number with 2 decimal places.

HINT: This query will show 3 records and 3 fields.

- c. We want to know how the annual tornado counts and number of casualties for Ohio, Pennsylvania, and West Virginia. Copy-and-paste this SQL code into a new query:

```
SELECT States.StateName, Year(Tornadoes.StormDate) AS
StormYear, Sum(Tornadoes.Deaths) AS SumOfDeaths,
Sum(Tornadoes.Injuries) AS SumOfInjuries,
Count(Tornadoes.TornadoID) AS NumberOfTornadoes
FROM States INNER JOIN Tornadoes ON States.StateAbbrev =
Tornadoes.StateAbbrev
GROUP BY States.StateName, Year(Tornadoes.StormDate)
HAVING (States.StateName="Ohio" Or
States.StateName="Pennsylvania" Or
States.StateName="West Virginia" Or
States.StateName="Kentucky" Or States.StateName="Virginia")
ORDER BY Count(Tornadoes.TornadoID) DESC, States.StateName,
Year(Tornadoes.StormDate);
```

IMPORTANT: Do not make any modifications to this query other than entering the above SQL code.

HINT: This query will show 201 records and 5 fields.



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- d. We would like to gather statistics on the number of tornadoes and casualties reported in each state. Copy-and-paste this SQL code into a new query:

```
SELECT States.StateName, Count(Tornadoes.TornadoID) AS  
NumberOfTornadoes, Iif(Sum(Tornadoes.Deaths) <>  
Null,Sum(Tornadoes.Deaths),0) AS SumOfDeaths,  
Iif(Sum(Tornadoes.Injuries) <> Null,Sum(Tornadoes.Injuries),0)  
AS SumOfInjuries  
FROM States LEFT JOIN Tornadoes ON States.StateAbbrev =  
Tornadoes.StateAbbrev  
GROUP BY States.StateName  
ORDER BY States.StateName;
```

IMPORTANT: Do not make any modifications to this query other than entering the above SQL code.

HINT: This query will show 51 records and 4 fields.

6. Run the Compact and Repair Database utility on your database. Ignore any errors you receive when running the utility.

Microsoft Excel Portion

7. Create a new Microsoft Excel workbook named **hw5_htwp_lastname_firstname.xlsx**.
8. We must adjust the sheets in our workbook.
- Rename *Sheet1* to *Regional Tornadoes*.
 - Add a new sheet named *Tornadoes by State*.
9. Import the following items into the workbook:
- Query5c* query from the Microsoft Access database – Import as a table starting in cell **A1** of the *Regional Tornadoes* sheet.

NOTE: Microsoft Access must be closed before importing the query.

- Query5d* query from the Microsoft Access database – Import as a table starting in cell **A1** of the *Tornadoes by State* sheet.

NOTE: Microsoft Access must be closed before importing the query.



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10. We would like to create a chart to display information on the number of tornadoes in each state.

Create a new 2-D clustered column chart based on cells **A1** through **B52** of the *Tornadoes by State* sheet. Move the chart to a new sheet named *Tornadoes by State Chart*.

Specify appropriate chart and axis titles. Format the vertical (value) axis as a number with no decimal places, using the 1000 separator.

11. To better understand our data, we wish to create a PivotTable.
- Create a new PivotTable based on the data in cells **A1** through **E202** of the *Regional Tornadoes* sheet. Place the PivotTable on a new sheet named *Regional Tornadoes PivotTable*.
 - On the PivotTable, do the following:
 - Add the year as a **Rows** field.
 - Add the state name as a **Columns** field.
 - Add the number of tornadoes as a **Values** field.
 - There is nothing to do for this step. Please proceed to the next step.

Microsoft Word Portion

12. Create a new Microsoft Word document named **hw5_htwp_lastname_firstname.docx**.
13. At the beginning of the document, insert a cover page using either of the built-in *Sideline* or *Whisp* styles. On the cover page, include the information noted below.
- Company:** The words Computer Science 101 Section followed by the section number in which you are enrolled.
 - Title:** Hail and Tornadoes
 - Subtitle:** Description and Classification
 - Author:** Your first and last name.
 - Date:** The current date.
14. Add a second page if one does not already exist. On it, insert the contents of the **tornadoes.rtf** file.

NOTE: The inserted text contains instructions (inside of "<>" symbols) for use in formatting the document. You must remove these instructions once you have applied the specified formatting.



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15. Where indicated, include the chart from the *Tornadoes by State Chart* sheet in your Microsoft Excel workbook. Size the chart to be 4-inches high and 6.5-inches wide. Add a caption and descriptive alt text for the chart.
16. Where indicated, insert a new equation using the Microsoft Word equation tool representing the formula below. Your formula must identically reproduce:
- $$\frac{\text{Number of tornadoes per year}}{\text{Land area}}$$
17. At the end of the document, we wish to create a bibliography page.
- a. Define the following website sources as references for your report:
- Type:** *Web site*
 - ◇ **Author:** Edwards, Roger
 - ◇ **Name of web page:** The Online Tornado FAQ
 - ◇ **Name of web site:** NOAA/NWS Storm Prediction Center
 - ◇ **Date:** February 19, 2023
 - ◇ **URL:** <https://www.spc.noaa.gov/faq/tornado/>
 - Type:** *Web site*
 - ◇ **Name of web page:** A Severe Weather Primer: Questions and Answers about Tornadoes
 - ◇ **Name of web site:** NOAA National Severe Storms Laboratory
 - ◇ **Date:** November 15, 2006
 - ◇ **URL:** http://www.nssl.noaa.gov/primer/tornado/tor_basics.html
 - Type:** *Book*
 - ◇ **Corporate Author:** American Meteorological Society
 - ◇ **Title:** Glossary of Meteorology
 - ◇ **Year:** 1999
 - ◇ **City:** Boston
 - ◇ **Publisher:** World Meteorological
 - ◇ **Edition:** 2nd
- b. Where indicated on the last page, insert a *Bibliography*-style bibliography using an APA style.



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18. We must finish formatting our document.

- a. Apply the formatting and changes to your report text as specified by the included comments.

Remove the included comments from your document once you have applied the required formatting.

- b. Ensure your document conforms to the following requirements:
 - i. Modify the *Normal* formatting style to specify Verdana 11-point as the default font.
 - ii. In the right-hand corner of the header on all pages after the cover page, list your last name followed by the page number. The page number should begin at 1 on the first actual page of text (the page after the cover page).
 - iii. The first line of your text paragraphs should be indented by 0.5-inch. Do not indent the cover page, headings, images, captions, equations, or bibliography.
 - iv. Except on the cover page, use double line spacing.
 - v. Ensure there is no (0-point) line spacing before and after each paragraph except on the cover page.
 - vi. Use 1.0-inch margins on all sides.

Microsoft PowerPoint Portion

19. Create a new Microsoft PowerPoint presentation named **hw5_htwp_lastname_firstname.pptx**.

20. In the presentation, create the following slides:

- a. *Title Slide*-type slide listing a title for the presentation, your name, course section, and an automatically updating date.
- b. *Title and Content*-type slide titled `Tornadoes by State`. Add the chart from the *Tornadoes by State Chart* sheet of your Microsoft Excel workbook to the content area of the slide.

21. Create *Title and Content*-type slides to answer three of the five analysis questions below. Respond to one question per slide. Title each slide with the name of the question being answered (e.g., "Question 21a").

- a. Is there a relationship between a state's geographical location within the continent and its frequency of tornadoes?
- b. Could a state's topography influence how many tornadoes occur?



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- c. Alaska has no tornadoes recorded having traveled at least 0.01 miles; only a handful have been recorded at all. Considering it is such a large state, why do you think it has such an extremely low number of tornadoes?
 - d. Every year, tornadoes cause millions of dollars of damage. What practical suggestions could you make to lessen this toll?
 - e. Examining the chart from the *Regional Tornadoes PivotTable* or raw data from 1970 to 2023, what patterns or trends do you observe? What might cause this?
22. We wish to apply formatting to the presentation. Use your best judgment to create a professional-looking presentation.
- a. Apply one design theme of your choice to all slides.
 - b. Apply an animation of your choice to the *Tornadoes by State* chart.
 - c. Apply slide transitions to all slides.
 - d. Edit the parent (top-most) slide master to add the **tornado.png** image to the bottom left corner of the slides. Size the image to be 0.5-inches high by 0.5-inches wide.
- NOTE:** Depending on the design theme used, the image may not appear on title slides. This is acceptable as long as the image is correctly added to the slide master.
- e. Add your name, an automatically updating date, and the slide number to the footer of all slides except the title slide.
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Assignment Requirements

You must submit all four files (Microsoft Access, Microsoft Excel, Microsoft PowerPoint, and Microsoft Word) for this assignment.



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Grading Rubric

This assignment is worth 60 points. It will be graded by your instructor using this rubric, with partial credit awarded as appropriate:

Steps 3-4	3 points total	Step 15	2.5 points
Step 5a-b	3 points each	Step 16	2.5 points
Steps 5c-d	2 points total	Steps 17a-b	5 points total
Steps 8-9	3 points total	Steps 18a-b	5 points total
Step 10	4 points	Steps 20a-b	3 points total
Steps 11a-c	5 points total	Steps 21a-e (pick 3 of 5)	3 points each
Step 13	3 points	Steps 22a-e	5 points total
Step 14	2 points		

The analysis questions in Steps 21a-e will be evaluated using this rubric:

Standard	Meets Requirements (1.5 points)	Does Not Meet Requirements (0 points)
Answer is reasonable.	Answer addresses the question prompt and is factually correct or a reasonable interpretation of available data.	Answer does not address the question prompt, is factually incorrect, or is an unreasonable interpretation of available data.
Answer is supported.	Logical rationale is provided to support the given answer.	Logical rationale is not provided to support the given answer.

Acknowledgments

The image in the introduction appears courtesy of Justin Hobson [2].

References

- [1] "Storm Events Database," *NOAA National Centers for Environmental Information*, 2023. Available: <https://www.ncdc.noaa.gov/stormevents/ftp.jsp>.
- [2] J. Hobson, *Category F5 Tornado Approaching Elie, Manitoba*. 2007. Available: https://commons.wikimedia.org/wiki/File:F5_tornado_Elie_Manitoba_2007.jpg.