**(This lab is from L. Snyder’s companion website to Fluency with Information Technology.  Modifications have been made to reflect CSI’s computer lab setup, and for timing. Answer all questions that are asked throughout the lab, and save your work. After you have completed the lab hand in a sheet with answers to the post-lab questions.)**

**Lab 1 Software and Data Storage**

**Post-lab Questions**

**Write your answers after completing the lab but read them carefully now and keep them in mind during the lab.**

1. Computers are unique in that they are general-purpose devices.  In other words, they were not designed for a very specific purpose, the way a watch is designed to keep time and a dictionary is designed to provide definitions.  As it turns out, however, computers can certainly both keep time and provide dictionary definitions.  **Name three other special-purpose devices or objects (not necessarily electronic) which do things that computers can also do with the appropriate software and/or hardware.**

1. **RAM and hard disks are both forms of data storage.  How are they alike? How are they different?** In particular, discuss the relative advantages and disadvantages of each.

1. **Describe at least one non-computing example of *hierarchical organization*in the real world**—something like the geography example given in the lab.

**Discussion and Procedure**

**Part 1. Running Software**

**A computer without software is a doorstop.**A VCR and TV are useful only with tapes of movies or television shows to play on them.  A stereo system is only useful with CDs, records or tapes to play on them.  Similarly, *software* (a collective term for computer programs or “applications”) makes computers useful to us.  By running different programs, we can use computers for a surprisingly wide variety of purposes, from writing reports to modifying photographs.  In order to use computing effectively, you need to know what kinds of software is available and what tasks each is suitable for.  The table below lists a few common kinds of software and describes what they are useful for.

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| --- | --- | --- |
| **kind of software** | **what it’s for** | **example products** |
| spreadsheet | calculations and analysis on tables of numerical data, e.g., tracking personal expenses, data from scientific experiments | Microsoft Excel, Lotus 1-2-3, Corel Quattro Pro |
| word processor | editing and formatting documents, e.g., letters, essays, resumes | Microsoft Word, Corel WordPerfect |
| database | storing and extracting structured information, e.g., on-line library catalog | Oracle, IBM DB2, Microsoft SQLServer |
| image editing | creating and modifying images, including computer-generated images, as well as photographs | Corel CorelDRAW, Adobe Photoshop |

To begin this lab, we will run a very simple program, a *text editor*, which is useful for creating and editing text that does not require any special kinds of lettering or formatting.  (Given this, a text editor is sufficient for writing a shopping list but not for writing a term paper with illustrations or some other complicated document.)

**How does a computer run a program?** A full explanation would require a whole book, so we will just discuss it at a high level here.  Recall that a *program*consists of instructions for the computer to execute—lots and lots of them. Programs are usually kept stored on a *hard disk*, because unlike *RAM*, disk storage does not get erased when the computer is powered down.  (Disks are sometimes called “disk drives” or just “drives.”)  Disks are also less expensive per unit storage than RAM.  There is a catch, of course: RAM is much faster than disk storage (by at least an order of magnitude), so when a program is run, the instructions are copied into RAM first, and the *processor*reads and executes instructions from there.

All of this happens very quickly, and you cannot see RAM being used, but there are at least two ways you can tell a hard disk is being accessed on most PCs.  First, many PC cases have a small LED lamp that lights up when the disk is being accessed.  Second, many hard disks make a muffled jittering noise when active.  Watch and listen for these signs throughout the lab whenever the disk is being accessed.

**\*\* MacOS Users can use TextEdit instead of Notepad and Finder instead of File Explorer\*\***

1. ***Run Notepad/TextEdit*.** In Windows, a common way of running a program is from the **Start** menu.  First, we will be using the **Notepad** program. This can be found through the start menu, **Start \ Notepad**, where \ indicates a submenu level. You can access the program by opening the start menu (click on the windows logo typically located at the bottom left of your screen or press the windows key on your keyboard). While the start menu is open, type in ‘Notepad’. The program ‘Notepad’ should now be the top result on your screen. Run the Notepad program by clicking on it, and if you are quick and attentive, you might notice the hard disk light go on and hear the disk access.  (Notepad is such a simple program that its size is very small, and the disk access might be over so quickly that you will miss it altogether.)

**MacOS Users: Launch TextEdit.** Once you have TextEdit Open, click on Format 🡪 Make Plain Text to later be able to save the file in .txt format.

**Chrome OS Users: Launch the ‘Text’ application.**

**ALTERNATIVE:** Another way to run Notepad on Windows is to select **Start \ Run...**, then type

notepad and press **Enter** or click **OK**. (Note that this does not work with all

programs.)

2. ***Edit plain text with Notepad (Windows), TextEdit (MacOS), Text App (ChromeOS)*.** Type a few lines of text—maybe a list of your favorite foods. Experiment with selecting text by dragging over it with the mouse—that is, hold down the mouse button and move the mouse over a region of text. Using the various selections under the **Edit** menu, you can delete, cut, copy and paste selected text. When you select text and do a copy it will appear as if nothing has happened. However, inside your Computer the text you selected has been copied into the RAM. Now, if you click somewhere else in the document and do a paste, a copy of the text you had selected will be placed there.

**Also try using the Undo option in the Edit menu (you can also use the keyboard shortcut, Ctrl + Z). How many changes can you actually “undo” using this feature?** For example, you may delete some text, then type some more withoutusing the backspace key.  What happens when you use undo?

The document you currently have open is stored only in RAM.  If your Computer were suddenly powered off (by a blackout, for instance), your text would be lost.  In the next section, we will discuss disk storage which is the solution to this problem. You can save your text to a file on disk for long-term storage. Before we actually do this, however, we need to discuss how disk storage is organized.

**Part 2. Files and File Folders**

**Keep your data in a file.**Just like almost everything else in computing, the storage capacity of hard disks increases every year. If we did not have some way of organizing the content, we would not be able to take advantage of such large amounts of storage space.

A file is one basic unit for storing and organizing data on disk.  In normal English, “file” usually means a folder for holding papers. When discussing data on computer disks, you should be aware that “file” is defined differently. More precisely, a file does not contain multiple documents but is the data on disk storing a single document.

**Fight clutter with organizational structure.**However, even if you name files carefully so that you can quickly identify their contents, a collection of more than a couple dozen files will probably be difficult to maintain.  In real life offices, documents are not kept in one enormous pile but are divided by subject and stored in folders and filing cabinets.  More generally, they are organized in a hierarchy, with multiple levels of categories and subcategories. You might consider doing the same with your own documents, like in this example hierarchy:



*hierarchy of folders for organizing document files*

1. ***Find some commonly used programs on your machine*.** **Paint** is a simple drawing and image editing program, **Internet Explorer** is a web browser, **Windows Media Player** lets you play music and video files, and **Calculator** is self-explanatory.  Where are these programs located in the Start menu?  Notate locations as we did with Notepad above.

**\*\* MacOS Users should open the Launchpad to see all the installed apps on their machines. As an example, you may simply list the programs as: Launchpad 🡪 TextEdit\*\***

**\*\* Chrome OS Users should simply launch the app menu by clicking on the circle icon on the leftmost side of the taskbar/Shelf on the Home Screen of their machine \*\***

**List Directions to Access Two Applications on your machine:**

**Examples:**

**On Windows - Start \ Notepad**

**On MacOS – Launchpad / Mail**

**On Chrome OS – Shelf / Gmail**

**Keep your files in folders.**You can organize files on a disk hierarchically by using *file folders*(also called *directories*or just *folders*). A directory is fundamentally different from a file in that a directory is a container for multiple files and other directories, rather than for the data for a single file.  They are called folders, because folders in real life serve a similar purpose.  That is, a folder itself is not a document you can read, but it holds documents and perhaps other folders inside it.  By grouping related files together and creating directories to store them in, you can make them easy to access for future use.  You can further organize your files by putting these directories in other directories reflecting even larger categories.

In Windows, there is a standard way of notating the location of a file on a disk.  First, the disk drive containing the file is identified with a letter.  By convention, drive letters A and B are used for floppy disk drives and C and D are usually used for hard disk drives.  This example specifies the location of a plain text file called outline.txt:

c:\documents\courses\music history\final paper\outline.txt

\*\*\*

**On MacOS, this may resemble Macintosh HD > Users > sidharthamishra > Downloads > lab.txt**

**Or if you are using iCloud on MacOS: iCloud Drive > Desktop > CSC 117 > lab.txt**

**On Chrome OS, this may resemble: My Files/CSC 117/lab.txt**

**\*\*\***

A filename with its location completely specified like this is sometimes called a *pathname*. Think of “path” as the sequence of folders you need to open to get to the file, starting from the drive. In this case, starting from drive C, you would have to open the documents folder, then courses inside that folder, then music history, then finally, final paper, where you would find the file outline.txt.

1. ***Save your file.***From the **File** menu, select **Save As...**. (or Save). This will bring up a dialog box that you can use to decide where to save the file and the name you would like to assign to it.  The dialog box opens with a particular folder and shows its contents (both files and folders). Click the **Save** in drop-down list to see what folders contain the current folder.

If you want to save your file in a different folder, you can change folders, by moving up or down in the hierarchy.

**\*\*On MacOS you can click on the dropdown next to “Where” to see more details\*\***

\*\***On Chrome OS, you can select the folder in the ‘Files’ Window. You can use the side pane to choose the location and folder where you would like to save the current file. You also have the option to move up the hierarchy by clicking on the name of the directory on the top ribbon/menu\*\***

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***On Chrome OS Choosing the Save as Option brings up the Files App Window***

Choose a filename carefully before saving. A good filename is concise but informative. Certain characters, including \ and \*, are not allowed in filenames.

**\*\*On MacOS, you also have the option to assign tags to files/folders for further organization. It can also make finding the files easier later on\*\***

**Part 3. File Properties**

We call characteristics of a file such as filename, size, and format file *properties*. Now that you have saved your text file, let’s take a look at its properties.

5. ***Locate the file in Explorer/Finder.***  You will **not** be using Notepad/TextEdit to examine your file’s properties, but we will leave it open in the background. So do not close Notepad/TextEdit.  Just *minimize* the Notepad window instead by clicking the leftmost of the three buttons

                        

on the right end of the title bar. Notepad will stay open but hidden, and you should see a button for it at the bottom of the screen in the taskbar.  You can click this button to restore the Notepad window.

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**On MacOS this is the Center Yellow Button on the Top Left with the – Symbol**



***On Chrome OS this is the Leftmost Button with the - Symbol***

                     Unless you saved your file on the **Desktop**, in which case it should be visible there, begin by opening (double-clicking) **My Computer** on the desktop.

\*\* **MacOS Users** can launch **Finder** for this step \*\*

\*\***Chrome OS Users** can launch the **Files** app for this step \*\*

Open the drive and open the folders containing your file. To find the example file outline.txt, you would start by opening the **C** drive, then open folders **work**, **courses**, **art history**, etc. in succession.

1. ***Examine your file’s properties.***  Right-click the file and select **Properties**. You will get a dialog box with lots of detailed information about your file, including the date and time it was last modified (sometimes called a “timestamp”).  Other commonly useful properties include the file’s *size*, measured in the standard unit of computer data storage, *bytes*. One byte can store one character (e.g., one letter, digit or symbol) of plain text.  For example, it would take 8 bytes to store the word “computer” in a plain text file.  The byte is a rather small unit, so file sizes are often measured in *kilobytes* (KB for short), where 1 KB is roughly a thousand bytes, or *megabytes*(MB), where 1 MB is roughly a thousand kilobytes. The capacity of PC hard disks today (2001) is typically measured in *gigabytes* (GB), approximately a thousand megabytes.

\*\* **MacOS Users: Select the file in Finder 🡪 Right Click/Two-Finger Tap 🡪 Get Info**

**This will bring up detailed properties about the file. \*\***

**\*\* Chrome OS Users: Select the File in Files 🡪 Right Click/Two-Finger Tap 🡪 Get Info \*\***

**WINDOWS ALTERNATIVE:** You can also select the file and press **Alt-Enter** to bring up the Properties dialog box for a file.

In the space below, write down the size of your text file in bytes, the time of its

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creation, the time of its last modification, and the time of its last access.

NOTE: Be careful not to change the **Attributes** settings of the file unless you understand what they do. When in doubt, close the Properties dialog by clicking **Cancel** instead of **OK**, and your file should be left unchanged.

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*7.* ***Modify the file and reexamine its properties.*** Close the Properties dialog, return to your Notepad/TextEdit/Text App window. Think of a short word (any word will do) and type it into your file somewhere.  Count the number of characters you added to your file.  (This is the number of letters in the word and maybe a space, if you added one.)  Save your changes, then write down which properties among the ones you records above, if any, you predict will have changed.

Check the properties. Which ones have changed and to what values?

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8. ***Examine the properties of the hard disk on your PC/Mac/Chromebook****.*  In addition to files, folders and disks have properties. How big is the hard disk on your computer, i.e., how much storage capacity does it offer?  How much of this storage space is being used?  You can find the answers to these questions by examining the hard disk’s properties.

Open the Start menu and type in ‘This PC’, then click on ‘This PC’. This will bring up a file explorer window. Select the hard disk (usually Drive C, with Drive D also present if there is a second hard disk) and open its Properties the way you did above.

**\*\*MacOS:** Click on Finder 🡪 Finder Menu Top Left of Screen 🡪 Preferences 🡪 General Tab 🡪 Click the Checkbox to Show the Hard Drives on Desktop **\*\***

**\*\*Chrome OS:**

**To Check the Storage on your Device:** Go to Settings App 🡪 Device (left pane) 🡪 Storage management

**To check the Storage Left on your Google Drive Plan :** Google Drive App 🡪 Read the Storage Details on the Left Pane

You can answer the question below using either or both of the above. However, make sure to label it accordingly.

**\*\***

**What is the total storage capacity of this disk?**

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**How much of this is being used?**

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Do not change any of the settings in the disk’s Properties window.  Click **Cancel**to close the window.

**Part 4. File Formats**

Although all programs save their data on disks as files, they often store them in a special *format*, a way of encoding information.  (File format is also known as file *type* and is shown under this name in the Windows file Properties dialog.)  The simplest file format is plain text, the format that Notepad and other text editors use, and files of this type are conventionally named with the txt *filename extension*. In Windows, every file format has a corresponding filename extension.  Each file is displayed with the *icon* (small image) associated with the program used for the file format, like the little spiral-bound notebook for Notepad. Notepad cannot open word processor document files (for example, those in Microsoft Word format), because they are in a format different from plain text that includes data for text style, such as italicization and underlining, in addition to the text itself. The table below lists some common file formats:

|  |  |
| --- | --- |
| **Extension** | **Description** |
| txt | plain text |
| doc | Microsoft Word document |
| pages | Pages Document on MacOS |
| gdoc | Google Docs Document |
| htm, html | web page (HTML source) |
| pdf | Portable Document Format (Adobe Acrobat) |
| zip | compressed set of files |
| gif | GIF image  |
| png | Portable Network Graphics |
| jpg/jpeg | Joint Photographic Group |

Remember how we said programs are read from disk into RAM when they are run?  Programs, just like all other data on disk, are stored as files, too, in their own format, with the exe extension. (The “exe” is short for “executable,” since “execution” can be used to refer to the process of running a program.)

**\*\*On MacOS the equivalent to .exe is .app (Application) \*\***

*9.****Examine Notepad’s / TextEdit’s properties*.**

**On Windows:** The Notepad program is stored as a file called notepad.exe and is usually located in the computer’s hard disk (often drive C) in a special folder named Windows, which contains lots of files essential to the operating system.  Find this file by double clicking ‘Local Disk (C:)’, then looking for the ‘Windows’ folder, then the ‘System32’ folder, and look for ‘notepad.exe’. Check notepad.exe’s properties.

**On MacOS:** The TextEdit application can be found under the Applications Folder. To locate it, open a Finder window 🡪 Applications (from the left sidebar) 🡪 TextEdit.app

**On Chrome OS:** Settings App 🡪 Apps 🡪 Text 🡪 More settings and Permissions 🡪Record the Size listed

What is the file format (type)? How big is it? When was it last accessed?

\*\***Chrome OS Users** do not need to list file type for this question\*\*

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NOTE: Be careful with the files in the special Windows folder.  If you delete,

rename, or move any of these files, your Computer might not work properly.  Your lab

computer should be set up to prevent you from doing this, but your own computer at home might not have such safeguards in place.

10. ***Create a Rich Text Document*.**

**On Windows:**

Run **WordPad** from the Start menu by typing in ‘Wordpad’ like how you did earlier for Notepad. (If you get an error at this point, try WordPad again.  If you still have trouble opening WordPad, use Microsoft Word instead.)

**On MacOS:**

Create a new TextEdit Document. This time, you should select Format 🡪 Make Rich Text. This will allow you to save the new file with a .rtf extension.

**On Chrome OS:**

Launch Google Docs and create a new Blank Document

**Once you have the appropriate application open (depending on your OS):**

Type one word and save the document in the same folder you saved your text file.  (WordPad/TextEdit will save the file with extension .rtf.) How many letters are in the word that you typed?

\*\***Chrome OS Users:** should type the word in the Google Docs Document and then:

File🡪 Download🡪Rich Text Format. This will download the file to your machine in the .rtf format.\*\*

**Record the word you typed below:**

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11. ***Examine your Rich Text Document’s properties*.** If you typed this same word in a plain text file, the resulting file would only take as many bytes as you counted letters. However, as you will see, the RTF file you just created is much bigger. Find your file in Explorer/Finder and check its properties.  What is its size?  (On Windows: Look for the size, not the “Size on disk.”)

\*\***Chrome OS Users:** Locate the file on your machine using the ‘My Files’ app and answer the question below \*\*

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12. ***Open your WordPad/Rich Text document in Notepad/TextEdit/Text App.***  This should immediately strike you as a strange thing to do. Notepad does not “understand” the WordPad file format and as a result, you should not be able to edit your document using Notepad.  However, a file is a file, and Notepad can be forced to open files whose format is not plain text. You would not normally ever do this kind of thing, but hopefully, it will illustrate how file formats work.

Run Notepad and select **Open...** from the **File** menu.  Open the folder where you saved your plain text and WordPad files.  Which of your two files do you see listed?

**\*\*MacOS and Chrome OS Users: Please skip this step\*\***

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Note that the drop down next to the **file name** entry has ‘Text Documents (\*.txt)’ in it. The \* is a special character that takes the place of any text, so this means that all files in the current directory that end with txt are listed. Try typing in ‘\*.rtf’ (\*.doc if  you are using Microsoft Word instead of Wordpad) in the **file name** entry to override the drop down selection and press **Enter**. Which of your files do you see now?

**\*\*MacOS and Chrome OS Users: Simply type in .txt or .rtf without the \* in the search box on the top right of the Finder/My Files Window and record your results\*\***

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Now, type \*.\* in the file name entry. With \* both before and after the . (the period), this will match all files, regardless of their filename extension.  Now, which of your files do you see?

\*\***MacOS and Chrome OS Users: Please skip this step\*\***

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**Windows Users:** Open your WordPad file in Notepad and describe what you see.  Briefly describe what you see.

**\*\*MacOS and Chrome OS Users: Please skip this step\*\***

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Do you see the word you typed into the WordPad file somewhere? \_\_\_\_\_\_\_\_\_

Close all applications before proceeding to the next section.

**Part 5. Managing Files and Directories**

13. ***Create a directory on your hard drive.***

**Windows Users:**

Open ‘**This PC**’ like you did earlier and open the **C**drive.

You should see a large folder icon in the middle of the menu options at the top. Click **New Folder**. A new folder should appear with its tentative name selected, allowing you to type its name immediately. Just press **Enter** for now and accept its name of New Folder.

**WINDOWS ALTERNATIVE:** If you do not see an icon, then you can also create a new folder by right clicking an empty space in the directory (make sure your mouse isn’t highlighting a folder or a file) then hover over ‘New’, then click ‘Folder’.

**\*\*MacOS Users:** You may create a folder on Desktop instead

**Open a new Finder Window 🡪 Navigate to Desktop 🡪 File 🡪 New Folder.**

(You may also right click on your Desktop and select New Folder)

**\*\***

\*\***Chrome OS Users:** You can create a folder on my device by going to the **Files App 🡪 My Files 🡪 Right Click/Two Finger Tap 🡪 New Folder\*\***

14. ***Rename your folder.***  Change the folder’s name to Lab 1. Right-click the folder and select **Rename**. The folder’s name will become selected, so when you start typing the new name, the old one will be replaced.  Both files and folders can be renamed in this way.

**ALTERNATIVES:** Click the folder to select it, then click the name of the folder once.

15. ***Copy your Notepad/.txt file to your folder*.** Now that you have created a new folder, let’s start copying the files you created into the folder.  To do this, open windows for both the *source*folder (where the file you want to copy is currently stored) and the *destination* folder (where you want to place the copy).  In this case, the source folder is where you stored your Notepad file in Step 4 above. The destination folder is the “Lab 1” folder you just created.

In the source folder window, select the Notepad/.txt file you want to copy by clicking it once. Right click the file, and choose **Copy**. Again, it appears as though nothing has happened, but the PC has made a note of which file you currently have selected.  Switch to the destination folder window and right clicking an empty space in the directory (make sure your mouse isn’t highlighting a folder or a file) and choose **Paste**. A copy of the file should be made there. This is not the only way of copying files, but it is among the easier ways, and it parallels text editing, making it easy to remember.

**Windows/Chome OS Keyboard Shortcut:** ctrl + c (to copy) then ctrl + v (to paste)**\*\***

**MacOS Keyboard Shortcut:** command + c (to copy) then cmd + v (to paste)

**Go back to the source and destination folders to make sure the file was indeed copied (rather than moved).  Without opening the files, how can you check to see that the files are indeed duplicates of each other?**

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16. ***Move your WordPad/Rich Text File (.rtf) to your new folder*.** Moving a file is just like copying, except rather than start by taking a copy of the file with **Copy** from the right-click menu, you choose **Cut**. Try moving your WordPad file from its current location to the new Lab folder. Again, after you are done, double-check both source and destination folders, this time making sure that the file only exists in the destination folder.

**Windows/Chrome OS Users:** You can also use the keyboard shortcut **ctrl + x** (to cut) and **ctrl + v** (to paste)

**MacOS Users:** You can drag and drop the file to your destination folder to move it. Alternatively, you may also use the following keyboard shortcut: **cmd + c** (to copy) then navigate to your destination folder and press: **cmd + option + v** (to move rather than copy) \*\*

17. ***Delete the WordPad/RTF file.***We are all humans and make mistakes, so at some point in your computing career, you will accidentally delete a file. To prepare for a situation like that, it is important to know some basic ways of recovering deleted files. First, start by deleting your WordPad/.rtf file from the Lab 1 folder.

You can simply select the file, then right click and choose **Delete** on Windows and Chrome OS **(‘Move to Trash’ on MacOS)**. That was your only copy of the file, so it might seem irrecoverably lost, but we will next see that you can usually recover accidentally deleted files.

18. ***Recover the WordPad/.rtf file.***The easiest way to “undelete” a file only works if you immediately realize your mistake and do not do too many other file operations, like copying, moving or more deleting.  Let’s try that first. Right click an empty space in the directory (make sure your mouse isn’t highlighting a folder or a file) and you should see a menu pop up with an option called **Undo Delete (Undo move of … on MacOS)**. Choose that and the file should reappear in the folder, just as before your “accidental” delete.

\*\***Please Note:** Chrome OS does not currently have a Trash or Recycle Bin built into the File System on your Device. However, if you accidentally delete a file on Google Drive, you may recover it by navigating to the Trash located on the left pane of the Google Drive app: Trash 🡪 Select the File 🡪 Right Click 🡪 Restore\*\*

**\*\*You can also press cmd + z on MacOS or ctrl + z on Windows\*\***

**ALTERNATIVE:** The way Windows/MacOS works, when you choose to delete a file, it usually does not actually get erased from the disk right away.  Instead, it goes to a special temporary storage folder called the **Recycle Bin/Trash**. This folder is on the **Desktop/Dock.** Try deleting your WordPad/.rtf file once more and find it in the **Recycle Bin/Trash**. You can move the deleted file from the Recycle Bin/Trash just as you would from any other source folder.  Recover the file by cutting and pasting/dragging and dropping it to your Lab 1 folder.

**\*\* Updated for MacOS by S.M. on Thursday, August 27, 2020 \*\***

**\*\* Updated for Windows 10 by E.C. on Thursday, August 27, 2020 \*\***

**\*\* Updated for Chrome OS (with other minor adjustments) by S.M. on Monday, February 8, 2021 \*\***