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Proceedings of the 2018 Pre-ICIS SIGDSA Symposium

Special Interest Group on Decision Support and Analytics (SIGDSA)

12-12-2018

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Recommended Citation
Frost, Raymond; Matta, Vic; and Kenyo, Lauren, "Plagiarism Prevention in Excel Assignments" (2018). *Proceedings of the 2018 Pre-ICIS SIGDSA Symposium*. 8.
https://aisel.aisnet.org/sigdsa2018/8

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Plagiarism Prevention in Excel Assignments

Teaching Track: Infrastructure (Extended Abstract)

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Abstract

Plagiarism is a growing problem in Excel-based assignments and tests. A system was developed that both prevents and detects plagiarism in assignments and tests. The system relies on a number of overt and covert features. The overt features help to prevent plagiarism by creating visible features that are easy to detect but hard to duplicate. Both the overt and covert features are also used to detect plagiarism if it occurs. The system uses four features to accomplish this: ubiquitous naming, watermarking, value shifting, and formula shifting. These features create a unique version of the assignment for each student, making it very difficult to copy another student's work. A fifth feature, used in concert with automatic grading, systematically detects whether any of the first four were tampered with. The system can be used for analytics assignments involving Excel. Future versions will try to tackle similar issues in Python and R.

Keywords

Plagiarism prevention, watermarking, counterfeiting, cheating, Excel

Introduction

Research shows that college cheating is widespread—about 70%—and that the problem is growing (Coakley & Tyran, 2001; Jones, 2011). Students cheat to get ahead or to avoid dire consequences—e.g. fail the course (Mark & Alexander, 2010). The ease of digital sharing has only exacerbated the problem. Furthermore, sites that facilitate sharing, such as Course Hero, publish completed assignments and exams from most universities in the United States. Efforts to thwart this type of plagiarism are not new. Techniques to combat plagiarism in Excel assignments have been around for almost two decades at the time of this research.

When grading writing assignments, programs such as Turnitin.com can verify the uniqueness of the student work. On many Excel assignments, however, professors often want students to turn in the same results, since they are solving the same problem. Because the submissions are virtually identical in content it is very hard to tell if a student turned in another student's work as their own (i.e., files have been shared or copied).

Note that most Excel anti-plagiarism these measures are covert rather than overt. They are designed to catch cheaters rather than overtly discourage them. In all likelihood these educators fear that revealing the detection measures will help students defeat them. Contrast this with the advertising campaigns that governments engage in to educate the public about anti-counterfeit measures. As one example, the US government ran primetime television ads on the top-rated Monday Night Football when colors were introduced to the twenty-dollar bill. Since the government is fairly confident that the measures cannot be defeated, they would rather advertise them and so use the entire population to help spot counterfeit bills.

We believe that students who cheat are equivalent to the casual counterfeiter. They are not hardened criminals, but rather, individuals who when put under pressure to perform in a limited amount of time are simply taking the easy way out by engaging in what they view as a largely victimless crime (Mark & Alexander, 2010). Therefore, overt measures that would dissuade a casual counterfeiter should work against student cheating.

The system described below introduces features on Excel assignments that are easy to spot and hard to duplicate. If a copied assignment is like a counterfeit bill, then educators must make it obvious that counterfeit protection is in place by using visible items such as watermarks that are nearly impossible to reproduce. Second, educators need to introduce unique features, similar to a bill's serial number, that make it clear that the assignment can be traced back to its original owner.

System Overview

Our enables instructors to easily create hands-on, Excel-based exercises that are unique to each student, and at the same time allow students to follow identical requirements and directions. Visual and covert measures are integrated into the system. Overt visual measures are intended to deter plagiarism among students. Additional invisible features provide a backup in case the overt measures are defeated. During the automatic grading process the system will detect any work that varies from the individually assigned content for each student and flag issues for instructors to look into further.

In Figure 1, the student's understanding of how the data must be transformed at each stage is assessed. Some of these transformations can be trivial—e.g. a sum function, whereas others could be a complex mathematical calculation or a sophisticated mix of nested functions as shown below. The answers and formulas from the instructor's answer key are stripped out of the start files, since they represent the work that students need to complete.

17	Product Cost Table						Order Summary			
18	Product	Setup Fee	Discount Volume	Normal Cost Per Item	Discount Cost Per Item		Item Quantity	Setup Fee	Cost Per Item	Item Total
19	P031 / Chain 20"	15	6000	1	0.95		1300			
20	P032 / Chain 24"	15	6000	1.2	1.15		1900			
21	P033 / Chain 26"	15	6000	1.25	1.2		0			
22	P034 / Wheel rim & tire 20"	20	2500	4.4	4.18		1000			
23	P035 / Wheel rim & tire 24"	20	2500	4.88	4.64		0			
24	P036 / Wheel rim & tire 26"	20	2500	5.12	4.86		1300			
25	P037 / Spokes 20"	10	200000	0.05	0.04		0			
26	P038 / Spokes 24"	10	200000	0.1	0.08		62000			
27	P039 / Spokes 26"	10	200000	0.15	0.13		0			
28	P040 / Nut 3/8"	15	100000	0.05	0.01		0			
29	P041 / Lock washer 3/8"	15	100000	0.08	0.03		0			
30	P042 / Bolt 3/8"	15	100000	0.06	0.02		30000			
31	P043 / Steel tubing 3/4"	45	10000	0.2	0.18		57000			
32	P044 / Paint	25	2500	0.3	0.27		0			
33	P045 / Shaft bearing	16	5000	0.2	0.18		14000			
34	P046 / Brake assembly	25	10000	1.6	1.44		3250			
35	P047 / Front wheel shaft	25	2000	0.2	0.18		8750			

Figure 1: Structured Assignment Example

System Features

The following enumerated points are the measures currently used in the system to prevent and detect instances of plagiarism.

1. The ubiquitous name: The student's name is repeated in multiple places in each workbook. It forms part of the filename, it is at the top of every worksheet tab, it is stored as the author in the file metadata, and it appears in occasional comments attached to optionally-selected cells (Figure 2). The student's name even appears in a hidden worksheet integrated into each start file (not shown). The ubiquitous name is our version of the serial number on a bill—but now repeated in many places.

2. Watermark. The student's name is watermarked with each letter colored in a different, custom color—like a rainbow effect – and each tab in a workbook has a different watermark. Figure 3 shows two tabs from a single workbook. Note that letters in the student's name are colored seemingly randomly. The watermark cannot be easily erased and replaced with another student's name. The retyped name would show all letters in the same color; therefore, the erasure would be obvious to the student and to the system. The system registers the exact watermark encoded in each tab of the workbook and compares those values with the submitted assignment.

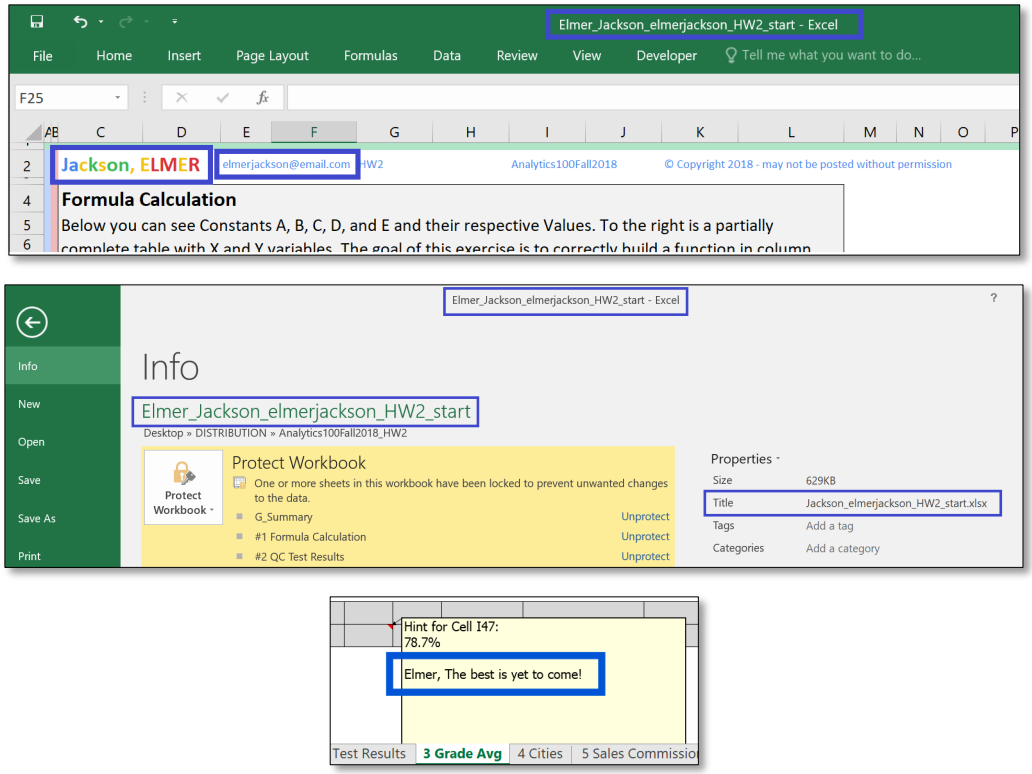


Figure 2: Student Name Repeated in Worksheet, Metadata, Filename and Comments

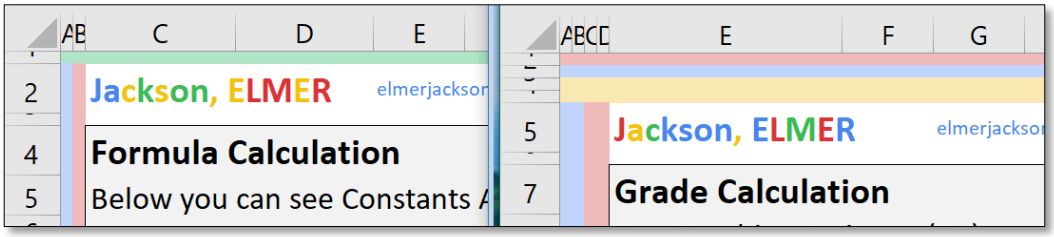
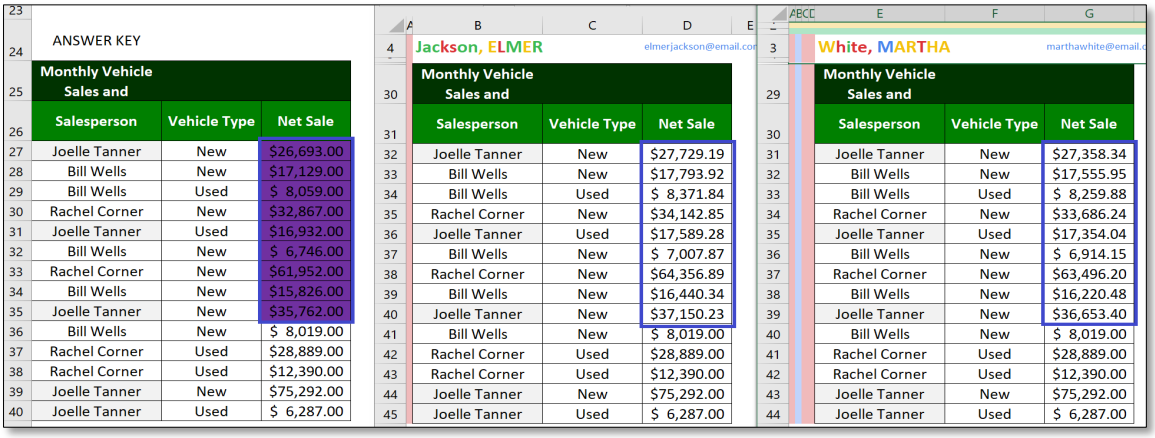


Figure 3: Watermarked Names Are Unique Per Tab

3. Value shifting: Value shifting refers to varying the values of the constants, or inputs, in each student file. The beauty of Excel is that it automatically recalculates the solution no matter how many inputs change, so every student can be given an expanded set of unique inputs. The professor has the option to designate values to be randomly varied (aka shifted) for each student. The professor also has the ability to adjust the limits of that variation—say, for example, up to five percent.

Figure 4, below, shows the same portion of spreadsheet from an answer key (left) and two different student start files (right). The answer key includes a set of cells colored in purple. These cells are the ones that a professor has chosen to shift for each student. The two sheets to the right show the resulting shifted values. Importantly, the variation is obvious to the students when comparing assignments and serves as a deterrent against cheating.

While unique inputs will deter some students, a clever student will keep their given inputs and just copy the formulas from another student. To combat this, the system alters or shift the formulas for every student, and again, tracks which student got which formulas.



ANSWER KEY

Monthly Vehicle Sales and		
Salesperson	Vehicle Type	Net Sale
Joelle Tanner	New	$26,693.00
Bill Wells	New	$17,129.00
Bill Wells	Used	$ 8,059.00
Rachel Corner	New	$32,867.00
Joelle Tanner	Used	$16,932.00
Bill Wells	New	$ 6,746.00
Rachel Corner	New	$61,952.00
Bill Wells	New	$15,826.00
Joelle Tanner	New	$35,762.00
Bill Wells	New	$ 8,019.00
Rachel Corner	Used	$28,889.00
Rachel Corner	Used	$12,390.00
Joelle Tanner	New	$75,292.00
Joelle Tanner	Used	$ 6,287.00

Jackson, ELMER elmerjackson@email.com

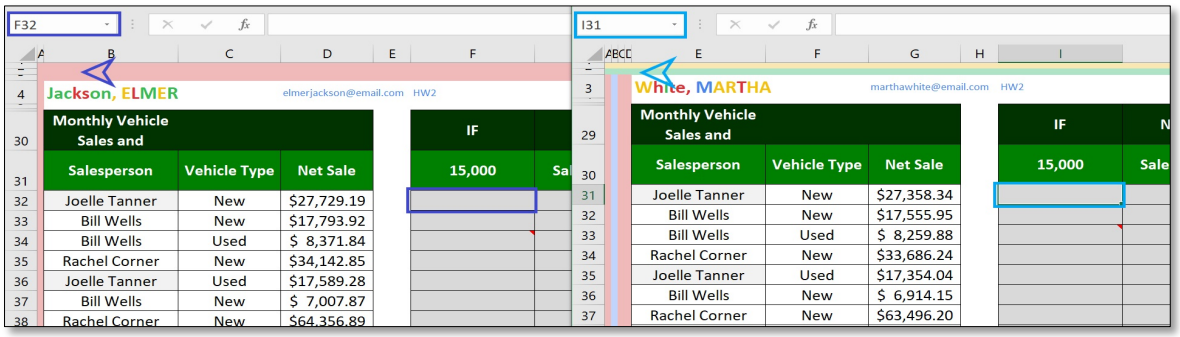
Monthly Vehicle Sales and		
Salesperson	Vehicle Type	Net Sale
Joelle Tanner	New	$27,729.19
Bill Wells	New	$17,793.92
Bill Wells	Used	$ 8,371.84
Rachel Corner	New	$34,142.85
Joelle Tanner	Used	$17,589.28
Bill Wells	New	$ 7,007.87
Rachel Corner	New	$64,356.89
Bill Wells	New	$16,440.34
Joelle Tanner	New	$37,150.23
Bill Wells	New	$ 8,019.00
Rachel Corner	Used	$28,889.00
Rachel Corner	Used	$12,390.00
Joelle Tanner	New	$75,292.00
Joelle Tanner	Used	$ 6,287.00

White, MARTHA marthawhite@email.c

Monthly Vehicle Sales and		
Salesperson	Vehicle Type	Net Sale
Joelle Tanner	New	$27,358.34
Bill Wells	New	$17,555.95
Bill Wells	Used	$ 8,259.88
Rachel Corner	New	$33,686.24
Joelle Tanner	Used	$17,354.04
Bill Wells	New	$ 6,914.15
Rachel Corner	New	$63,496.20
Bill Wells	New	$16,220.48
Joelle Tanner	New	$36,653.40
Bill Wells	New	$ 8,019.00
Rachel Corner	Used	$28,889.00
Rachel Corner	Used	$12,390.00
Joelle Tanner	New	$75,292.00
Joelle Tanner	Used	$ 6,287.00

Figure 4: Given Values are Randomly Varied from Answer Key

4. Formula shifting: Formula shifting enables the professor to shift all the formula references in each student's file. The system does this by inserting randomly varied numbers of colored rows and columns into each worksheet above and to the left of cell A1 (Figure 5). Th changes the placement of each student's given cells, which makes copying exact formulas from another student's files nearly impossible. Note that in Figure 5 the first blank cell in one student's file is F32, while the other student's is located in I31. Furthermore, the system randomly colors each inserted row or column to make this variation obvious to the students.



F32

Jackson, ELMER elmerjackson@email.com HW2

Monthly Vehicle Sales and		
Salesperson	Vehicle Type	Net Sale
Joelle Tanner	New	$27,729.19
Bill Wells	New	$17,793.92
Bill Wells	Used	$ 8,371.84
Rachel Corner	New	$34,142.85
Joelle Tanner	Used	$17,589.28
Bill Wells	New	$ 7,007.87
Rachel Corner	New	$64,356.89

IF	
15,000	Sa

I31

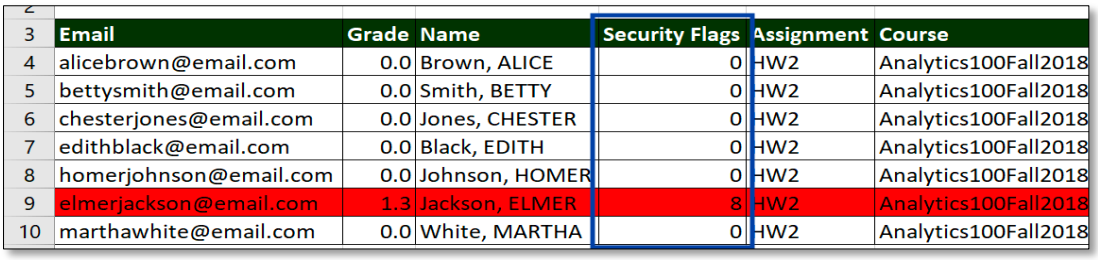
White, MARTHA marthawhite@email.com HW2

Monthly Vehicle Sales and		
Salesperson	Vehicle Type	Net Sale
Joelle Tanner	New	$27,358.34
Bill Wells	New	$17,555.95
Bill Wells	Used	$ 8,259.88
Rachel Corner	New	$33,686.24
Joelle Tanner	Used	$17,354.04
Bill Wells	New	$ 6,914.15
Rachel Corner	New	$63,496.20

IF	
15,000	Sale

Figure 5: Formula Shifting: F32 for ELMER is I31 for MARTHA

5. Plagiarism Detection: During grading, the system checks all the counterfeit protections against the file distributed to each individual student. Any discrepancies between the given file and the file submitted by the student are flagged, counted and highlighted in the professor's grade roll sheet, as seen below in Figure 6. Instructors can quickly see which assignments may need further inspection.



Email	Grade	Name	Security Flags	Assignment	Course
alicebrown@email.com	0.0	Brown, ALICE	0	HW2	Analytics100Fall2018
bettysmith@email.com	0.0	Smith, BETTY	0	HW2	Analytics100Fall2018
chesterjones@email.com	0.0	Jones, CHESTER	0	HW2	Analytics100Fall2018
edithblack@email.com	0.0	Black, EDITH	0	HW2	Analytics100Fall2018
homerjohnson@email.com	0.0	Johnson, HOMER	0	HW2	Analytics100Fall2018
elmerjackson@email.com	1.3	Jackson, ELMER	8	HW2	Analytics100Fall2018
marthawhite@email.com	0.0	White, MARTHA	0	HW2	Analytics100Fall2018

Figure 6: Security Flags in the Grade Roll

The security checks are broken down in more detail in each student's graded file. All watermarks, formula shifting quantities and colors and shifted values are recorded and visually compared in a table in every student's graded file. In the case of copied work, the uniqueness of the watermarks, shifted values and formula shifting either directly show which students were involved (if the name is altered), or are so specific that determining the source of the copied data is relatively easy (Figure 7).

Sheet	Security	Distributed	Submitted	Matc
1 Formula Calculation	Watermark	White, MARTHA	Jackson, ELMER	FALSE
5 Sales Commissions	Watermark	White, MARTHA	Jackson Elmer	FALSE
5 Sales Commissions	VS: G31	27358.34	27729.19	FALSE
5 Sales Commissions	VS: G32	17555.95	17793.92	FALSE
5 Sales Commissions	VS: G33	8259.88	8371.84	FALSE
5 Sales Commissions	VS: G34	33686.24	34142.85	FALSE
5 Sales Commissions	VS: G35	17354.04	17589.28	FALSE
5 Sales Commissions	VS: G36	6914.15	7007.87	FALSE
1 Formula Calculation	Formula Shift	|YYYY|YYYY|YYYY|BBBB|	|YYYY|YYYY|YYYY|BBBB|	TRUE
2 QC Test Results	Watermark	White, MARTHA	White, MARTHA	TRUE
2 QC Test Results	Formula Shift	|BBBB|YBB?|YBB?|YBB?|	|BBBB|YBB?|YBB?|YBB?|	TRUE
3 Grade Avg	Watermark	White, MARTHA	White, MARTHA	TRUE
3 Grade Avg	Formula Shift	|RRRR|YYYY|RRRR|GGGG|	|RRRR|YYYY|RRRR|GGGG|	TRUE
4 Cities	Watermark	White, MARTHA	White, MARTHA	TRUE
4 Cities	Formula Shift	|RRRR|GGGG|R???|R???|	|RRRR|GGGG|R???|R???|	TRUE
5 Sales Commissions	Formula Shift	|YYYY|RRRR|GBGG|GBGG|	|YYYY|RRRR|GBGG|GBGG|	TRUE
5 Sales Commissions	VS: G37	63496.2	63496.2	TRUE
5 Sales Commissions	VS: G38	16220.48	16220.48	TRUE
5 Sales Commissions	VS: G39	36653.4	36653.4	TRUE
6 Pay Raise	Watermark	White, MARTHA	White, MARTHA	TRUE
6 Pay Raise	Formula Shift	|RRRR|YRRR|YRRR|YRRR|	|RRRR|YRRR|YRRR|YRRR|	TRUE
6 Pay Raise	VS: H29	46499.69	46499.69	TRUE
6 Pay Raise	VS: H30	30214.64	30214.64	TRUE
6 Pay Raise	VS: H31	63997.59	63997.59	TRUE

Figure 7: Security Checks in Student Files

Once students see how different their files are from other students' files and how carefully their work is being checked for uniqueness, they are much less likely to attempt to use or copy another student's work. Even if they do work together, each student must – at the very least – go through the steps of typing their own formulas and functions and referencing the correct cells to solve the task.

Discussion

We have discussed the four overt ways to combat plagiarism: ubiquitous naming, watermarking, value shifting, and formula shifting. These ways are similar to anti-counterfeiting measures used with currency. Governments work hard to make it easy to detect counterfeit currency. If anti-counterfeit measures are readily visible, counterfeiting is less likely to occur. Likewise, we recommend exposing most of the security that is used to detect plagiarism.

References

Coakley, J., & Tyran, C. (2001). Can e-cheating be prevented? An approach to detect plagiarism in computer skills courses. *AMCIS 2001 Proceedings*, 241.

Jones, D. L. R. (2011). Academic Dishonesty: Are More Students Cheating? *Business Communication Quarterly, 74*(2), 141-150. doi:10.1177/1080569911404059

Mark, G. S., & Alexander, M. (2010). Why Do College Students Cheat? *Journal of Business Ethics*(3), 441.

Ratcliffe, J. (2006). *Video surveillance of public places*: Citeseer.