



Team Lucky Sevens

TS2-7

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“Just Walk on By?”

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EF 157

Problem Statement

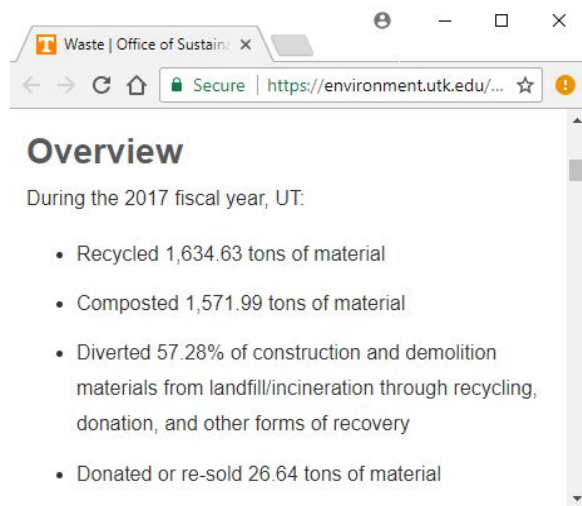
This assignment is about finding a estimate using data we collect to, as accurately as possible, find the total number of fliers handed out on Ped Walkway, the percentage of people who keep, recycle, trash, or throw the fliers on the ground, how many days it would take to cover the walkway with discarded fliers, the amount of trees needed, and the cost of the fliers handed out in a school week.

Background

Why are we gathering this data?

We are interested in collecting this data because the University of Tennessee is interested in becoming as environmentally-friendly as possible. In fact, according to [3], UT's goal is to become "a Zero Waste institution by diverting at least 90% of all waste from the landfill through reducing, reusing, recycling, and composting practices." In order to improve campus cleanliness and minimize waste, it is important for the University to gather data that identifies the problems. This is where our data becomes useful; if we understand what is done with fliers that are handed out on Ped Walkway, we are one step closer to reducing paper waste on campus.

When has similar data been collected?



The University of Tennessee has conducted research related to this problem before. This screenshot from [2] displays some data related to waste/recycling in 2017. Additionally, UT published an environmental impact report on [2] for the fiscal year 2017 that highlights eco-friendly improvements on campus and showcases some of the positive changes they have provoked. Our data could help the University continue this green-friendly trend by identifying problem-solving methods related to paper waste via handouts on Ped Walkway.

What assumptions will we make to keep our data as accurate as possible?

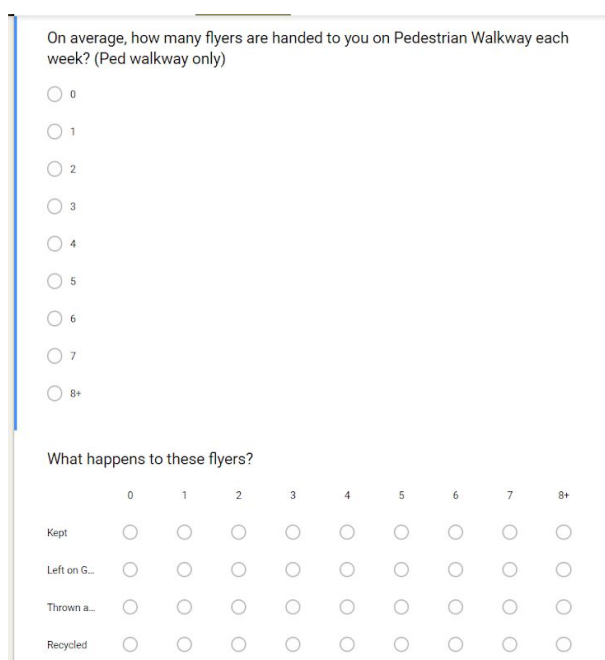
When measurement errors, outliers, and other factors are taken into account, we believe that our means of collecting data can be most accurately described with two significant figures. We recognized that we can not be too precise with as many estimates as we made.

Narrative

We considered different approaches to getting the data we needed. We mainly thought about surveying people on ped walkway personally, handing out surveys on the walkway for people to complete there, or creating a digital google form. We eventually went with the google form as the method for data collection for convenience of the participants and the most participant reach.

Creating the form also required a great deal of thought. Initially we considered asking text based questions for people to enter in how many fliers they received and how many did they keep, threw away, recycle, and left on the ground. We soon realized that this had many issues. First, we felt that as lazy/busy college students, most of our participants would not want to answer 5 short response questions. Second, we felt that analysis would be more difficult because of the open-ended nature of the questions. Thus, we decided to go with the least amount of multiple-choice questions possible to alleviate these issues (refer to figure 1.0). After that, we decided that they best way to reach the most people and get their responses quickly would be to send the survey to groupmes/groupchats that we were in.

Figure 1.0



On average, how many fliers are handed to you on Pedestrian Walkway each week? (Ped walkway only)

☐ 0

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

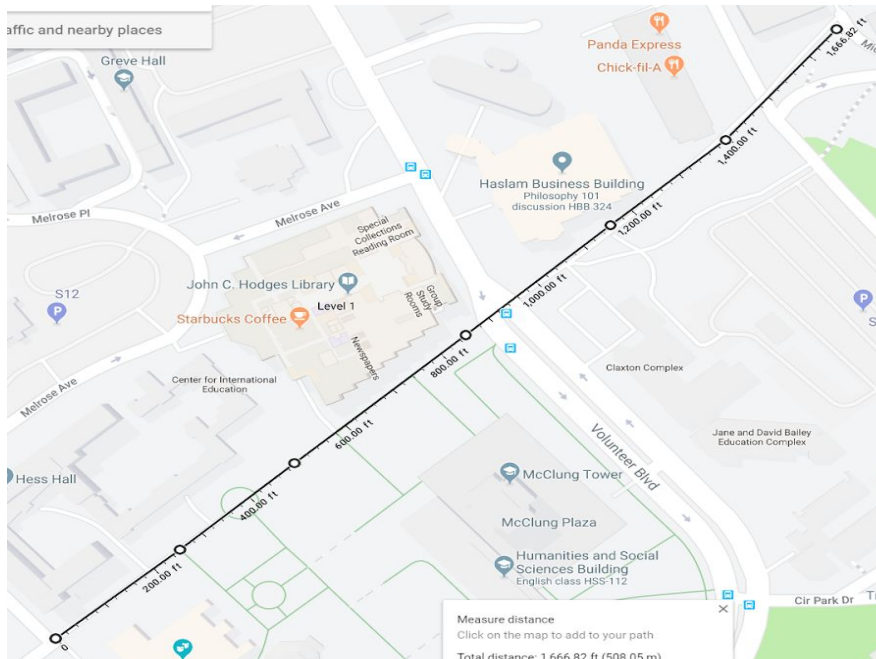
☐ 8+

What happens to these fliers?

	0	1	2	3	4	5	6	7	8+
Kept	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Left on G...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thrown a...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recycled	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For getting surface area of ped walkway we first thought about measuring the dimensions, but we quickly shot that down because of the time it would take. Instead, we went on google maps and used its 'measure distance' feature to find the length and width of the different parts of ped walkway.

To determine the total number of fliers handed out in a typical school week, we took the average number of fliers received by a student from our poll and multiplied by the undergraduate population: (2.299 fliers per student) x (22,139 students) = 50,897 fliers.



To figure out how many days it would take to completely cover Ped Walkway with the discarded fliers, we had to figure out the surface area of Ped Walkway, divide that by the surface area of the average flier, and divide that by the average number of fliers discarded per day. We analyzed several fliers being handed out on Ped Walkway throughout the week and determined the average flier size was half a sheet of paper, or $0.03016m^2$. To determine the surface area of Ped Walkway, we calculated the dimensions of it using Google Maps and multiplied the lengths and widths of different parts of the walkway. To determine the number of fliers discarded per day, we multiplied the total number of fliers handed out per day by the total percent thrown away, left on the ground. Then we divided the surface area of Ped Walkway by the surface area of the average flier to determine how many fliers it takes to cover the walkway. Last, we divided this number by the average number of fliers discarded per day.

$$\begin{aligned} &\text{Surface area of Ped Walkway} \\ &\text{Before Bridge} \quad \text{Before Bridge} \quad \text{On Bridge} \\ &(9.42m)(101.31m) + (\pi(15.805^2m)) + (154.79m)(10.92m) + (4.41m)(85.86m) = 4,237.3524m^2 \\ &\text{Fliers it Takes to Cover Ped Walkway} \\ &\text{Ped Walkway} \quad \text{Flier} \\ &(4,237.354m^2) / (0.03016m^2) = 140,495.822 \text{ fliers} \end{aligned}$$

$$\begin{aligned} (50,896.88 \text{ fliers per 5 days}) &= 10179.38 \text{ fliers per day} \\ (101,79.38 \text{ fliers per day})(76 / 100 \text{ fliers discarded}) &= 7,736.33 \text{ discarded fliers per day} \\ (140,495.822 \text{ fliers}) / (7,736.33 \text{ discarded fliers per day}) &= 18.16 \text{ days, or 19 days} \end{aligned}$$

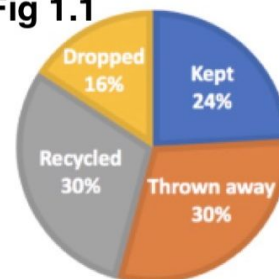
To determine the number of trees required to print 50,897 fliers, which requires 25,449 pieces of paper (assuming 2 fliers can be printed on a standard 8.5x11 sheet of paper), we researched the average number of sheets a single tree could produce. According to the research, approximately 8,333 sheets of paper can be produced from a single tree [1]. $(25,449 \text{ sheets of paper}) / (8,333 \text{ sheets per tree}) = 3.054 \text{ trees}$. Although the calculated value is less than 4 trees, one would have to use a 4th tree to produce the required amount of sheets of paper.

Results

- Total number of “fliers” that are handed to passersby on Ped Walkway in a “typical school week”: 50,897
 - Percent kept by the passerby: 24%
 - Percent recycled: 30%
 - Percent thrown in the trash: 30%
 - Percent thrown on the ground: 16%
- Amount of days it would take to completely cover Ped Walkway with all the discarded fliers if they were laid next to each other: 19 days
- Number of trees harvested to produce the fliers handed out in a typical school week: 4
- Total cost of producing the fliers handed out in a typical school week: \$12,724.22

WHAT HAPPENED TO THE FLIERS?

Fig 1.1



# of fliers	Responses
0	13
1	21
2	27
3	21
4	6
5	3
6	1
7	0
8+	5

Fig 1.2

Recommendations and Conclusions

$(50897 * .46(\text{total percent thrown on the ground and in the trash})) = 243412.62 \text{ fliers}$

$(23412.62 \text{ fliers}) / (2 \text{ fliers/sheets}) = 11706.31 = 12000 \text{ sheets of paper was wasted every week}$

$11706.31 \text{ sheets} / 8333(\text{sheets/trees}) = 1.404 \text{ trees} = 1.4 \text{ trees wasted through discarded fliers per week}$

That means that $(11706.31 \text{ sheets} * .50\$) = 5853.16 = \$5900$ wasted on printing fliers that are discarded each week.

We noticed several flaws with our result:

- a.) One of the most apparent flaws we discovered in our data collection is that our surveys were conducted at the beginning of the year, when there is a disproportionate number of outreach being conducted on Ped Walkway. Our data may not translate later in the semester when club recruitment has slowed down significantly.

b.) Another flaw with our data is that students taking the survey have the power to respond in any way they feel. Dishonesty may affect our results because students might be compelled to overestimate the amount of recycling they do, and underestimate their littering habits.

c.) Our survey was primarily sent to freshmen living on campus due to who we sent the surveys to. We recognize that many other students(particularly upperclassmen) living off-campus spend significantly less time on Ped Walkway than on-campus freshmen, and therefore generally receive fewer handouts.

d.) We noticed a difference between the number of fliers received and the number of fliers kept, thrown away, etc. on many responses because of the way we created the survey. We were forced to eliminate these responses because the data could not be used.

What would we do differently?

- a) To more accurately collect data, we would collect a larger sample size. By doing this, we would be able to more accurately predict the average number of fliers handed out to each person.
- b) Additionally, it would be helpful to have more observation of fliers being handed out on pedestrian walkway. By spending more time on pedestrian walkway observing the activity, it would eliminate the bias that can occur through an anonymous survey.
- c) It would also be helpful if the survey was sent to more groups than those containing primarily freshmen. Most freshman live in the dorms, requiring them to constantly use pedestrian walkway to get places. Upperclassmen may have alternate means of commuting to and from the academic buildings.
- d) Finally, it would be helpful to collect the data over the course of the entire academic year. Most organizations are promoting at the beginning of the year in an attempt to get members to join.

List of References

- [1] Greenatworkmag.com, “One Tree = How Much Paper?,” Sept./Oct. 2003. [Online]. Available: <http://www.greenatworkmag.com/gwsbaccess/03sepoct/special2.html> [Accessed 10 Sep. 2018].

- [2] The University of Tennessee Knoxville, “Office of Sustainability,” *The University of Tennessee Knoxville*, 2018. [Online]. Available: <https://environment.utk.edu/topics/waste/> [Accessed: Sept. 10, 2018].

- [3] The University of Tennessee Knoxville, “UT Recycling,” *The University of Tennessee Knoxville*, 2018. [Online]. Available: <https://recycle.utk.edu/> [Accessed: Sept. 10, 2018].