Team F I.3

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100/100

Parking Meters at Carnegie Mellon University

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A. Why is this topic interesting? Why does this survey need to be done now? Is there a client for whom you might do the survey?

Coin parking meters are becoming a rarity in today's technologically advanced era, so why at Carnegie Mellon has there not been a technological improvement in terms of parking on its campus since CMU is known for being such a big tech hub? In reality, Carnegie Mellon is in working stages of implementing technological improvements in terms of parking on its campus (i.e. Traffic21, ParkPGH). We want to survey on campus parking meters to determine if there is a high frequency in unpaid meters. To add, we would like to see if there are any correlations between other factors, such as owning an expensive car, time of day, etc. This project is very interesting for anyone who uses the parking meters on campus, especially those who have been ticketed for parking violations.

B. What question(s) do you propose to study? Give a brief answer that would have been understandable by a non-statistician.

We wish to look at different aspects of meter parking at Carnegie Mellon University:
a.   How frequent do people not pay meters
b.   Are certain days/times more likely to have unpaid meters
c.   Are different types (color/brand/model) of cars more likely to be at an unpaid meter
d.   Are cars registered as Pennsylvanian or outside states (by checking license plate) more likely to be at an unpaid meter

In our project we would like to survey the parking meters at different times and on different days and record how frequently they are unpaid and which types of cars are parked there. Depending on what we find out, we would like to see if there should be a push to seek alternative methods to coin operated parking meters.

C. What research has already been done on the topic or on the theoretical construct of central importance to your topic? What could be learned from survey results? Each group member should locate and review 1 relevant piece of research (e.g., article, report, book, etc).

1) Nancy Geronian: "Local, national companies contracted for parking meter efficiency: Revenue rises in Tampa with new meter technology" from Tampa Bay Business Journal by Mark Holan, Staff Writer on Friday December 31, 2011. Web. <http://www.bizjournals.com/tampabay/print-edition/2010/12/31/local-national-companies-contracted.html?page=all>.

Summary: The key point of this article states how advancing meter technology will

reduce costs, increase revenue, and improve convenience, so in our project we can show how inefficient regular coin parking meters really are.

2) Kaylee Makel: Goals, IndustriesBy ApplicationsBy. "Integrated Parking Management." *Parking Solutions, Multi-Space Parking Meters | Digital Payment Technologies*. 2011. Web. 28 Jan. 2012. <http://www.digitalpaytech.com/parking-solutions/integrated-parking-management.aspx>.

Summary: As technology advances, consumers are now able to pay their parking meters via phone without bearing weather conditions or leaving an office meeting. Parking meters are now being monitored by space sensors using a Smartphone application which yields immediate payment without ever having to visit the pay station. This sort of technological advancement is beneficial for consumers, especially students and professors on a tight schedule.

3) Jeff Lee: "Environmental Indicators for Carnegie Mellon University: Baseline Assessment." 2004. Web. <http://www.cmu.edu/greenpractices/campus-assessment/environmental-indicators/transportation.pdf> .

Summary: CMU wants to reduce the number of vehicles that travel to campus whereas more and more people find the convenience of driving to campus well worth the cost of permit/metered parking and/or the risk of being fined. There are multiple reasons as to why, including poor public transportation, unreliable shuttle service, and close proximity of metered parking.

4) Jung Moon Jang: M. Grynbaum, "The Last Days of the Old Parking Meter." September 18, 2011. <http://www.nytimes.com/2011/09/19/nyregion/uprooting-the-old-familiar-parking-meter.html?pagewanted=all>.

Summary: New York City has replaced all of the parking meters to a solar-powered meter with Wi-Fi and ability to control eight parking spaces at once and to speak seven languages. The new meter system is very convenient because instead of carrying coins in pocket, people can pay with credit card. Also, because the parking meters no longer define each spot, it is expected that the city will have 10 to 15% more parking spaces.

5) Victor Wilczynski: "Advanced Parking Meters Help Increase Asbury Park's Parking Revenue by More Than 60 Percent." November 1, 2011. <http://www.marketwatch.com/story/advanced-parking-meters-help-increase-asbury-parks-parking-revenue-by-more-than-60-percent-2011-11-01>.

Summary: The installment of 100 multi-space parking pay stations in New Jersey has increased parking revenue over 60 percent. The parking stations allow many different payment options including cash, coins, credit, and debit, so maybe Carnegie Mellon University should make a switch to more efficient methods.

D. What is the sampling frame? What population or populations do you plan to sample from?

The sampling frame: All parking meters on campus (Frew Street, Tech Street, and Margaret Morrison Street, and meters in front of the University Center).

E. What is the target population? To what population(s) do you wish to make inferences? How does the target population differ from the sampling frame, for your survey? What possible sampling and non-sampling errors could arise in the survey that you plan to conduct?
Explain each possible error, how it could occur, and how you suggest tackling it.

The target population is all on campus parking meters, since our target population is not that large in size, we can observe all units in the target population. The survey is going to be a census of parking meters at CMU. We are not sampling the drivers of these vehicles, since it is impracticable plan to wait around for the driver to hand them a survey or stick a survey into their windshield. Reason being, people out of their consciousness will not want to admit that they blatantly did not pay their meter. The sampling frame is the meters on three streets on campus and in the parking lot by the UC mentioned in part D.

We could see a sampling error in variance, although the three streets are located next to each other, they could be more attractive to different drivers considering the buildings they are closest to. We will handle this by analyzing the data for each street as well as combined to see if there is any significant difference. Although we will be able to survey every meter each time we survey, there may not always be a car parked at it. This can be a variable in our data: measure of usage. This information is valuable because if we notice a certain time where there are very few cars then monitoring habits can be adjusted accordingly by the parking authority.

Another error could be a measurement error, since we do not know if a parking meter is broken or not. If it is broken, the driver is not able to pay and if we cannot identify that the driver has not paid because the meter is broken or for some other reasons, that would be a measurement error.

F. What is the mode of data collection? How do you plan to carry out the survey (e.g., by telephone, e-mail) and why?

We would like to conduct a census of the peter parking areas around campus. A self administered or face-to-face questionnaire would not be feasible in conducting our study. It would also be impossible to record responses of commuters who utilize parking meters. However, a census of meter parked cars will be feasible because it's relatively small sample. We also found that meter fees apply between 8 a.m. and 5 p.m. on weekdays and are not required on weekends. Therefore we plan to conduct a study specific to hours of required parking fees at parking meters. We will choose to categorize the time variable into every 3 hour bins. We plan to conduct the study by observing every individual meter parking spaces located in the South-East side of campus (i.e. Margaret Morrison Street,

Tech Street, Frew Street) as well as the parking meters located near University Center and East Parking Garage. We will have several question specific response questions (e.g Time Left on Meter) as well as several categorical (e.g. Day of the Week, Color of Car) response checklist for each parking space.

G. What variables do you propose to measure?

Our main focus will be to see if there is an abundance of people parking illegally. However, we will also look at factors such as timing to see if there are certain times of day or certain days of the week that there is a higher frequency of illegal parking. We are going to record what state the car is registered (license plate) to see if there is a difference of out of state versus Pennsylvanian residents. We also are going to make note of variables such as make/model and color to see if there is any connection with these factors and illegal parking.

H. On the basis of feedback to your submission for Parts I and II, choose a final survey topic, and update or revise your answers to (A) through (G) above. Submit the revised proposal.