Analysis of the Off-Campus Housing Search for CMU Students

36-303 | Team E
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Introduction

Research Question and Motivation

The purpose of this study is to identify Carnegie Mellon University (CMU) student housing preferences along with the most common difficulties that CMU students currently face in searching for off-campus housing. Finding off-campus housing, a residence with less certainty and safety compared to school dormitories, is essentially the first independent search for the majority of college students. It is not hard to associate this searching experience with difficulty and frustration. Armed merely with such tools as "Craigslist.org," "Rent.com," and "CMU Misc. Market," CMU students can be jeopardized, especially by the lack of efficiency, safety, and valid information. This survey is intended to identify existing difficulties and provide a strong basis for viable resolutions. Moreover, we are interested in the students' preferences in off-campus housing. The results of this survey will be of great interest to many, such as CMU Student Affairs, property managers, college students, and college students' parents.

Citations to Related Literature

We found several articles and studies relevant to our research question. Similar to our study, Duke University has conducted multiple off-campus housing surveys, focusing on crime rates and housing conditions (Duke University, 2009). From this survey, Duke University has been able to provide students and other community members with information about different off-campus housing areas. Georgetown University has also conducted a housing survey to learn more about the trends and experiences of finding off-campus housing (Georgetown University, 2010). Additionally, articles have been written concerning student's advice in the housing search and housing preferences. "Students share stories, advice about off-campus housing" by Victoria Ison is an article supplemented with various interviews concerning student advice in the off-campus housing search (Ison, 2012). "Students Don't Often Consider Fire Safety," from the Connecticut Post by Linda Conner Lambeck, and "Off-campus, with Elbow Room," by Joyce Cohen, discuss important features that should be looked for by college students when looking for off-campus housing (Lambeck, 2012; Cohen, 2012).

Summary of Main Results

We divided our sample into two main groups, undergraduate and graduate students, and found varying results between the groups. We mainly looked at search platforms and the level of satisfaction for each. No one platform provided a significantly higher level of satisfaction. For undergraduates, online sources were the most favored search platforms and word-of-mouth and online were considered to be the most accessible. Housing and Dining Services was considered to be the most adequate and accurate among undergraduate students who have not previously searched for housing. However, those who have used Housing and Dining Services have had relatively low satisfaction. As for graduates, the highest level of satisfaction for a searching platform was achieved when the platform was adequate. To go deeper into the specifics of the preference of undergraduates and graduates, we have found that both groups prefer apartments to houses. Sharing the house seems like the preferred method of living for undergraduates; however, graduates seem to prefer living by themselves. Differences in preferences among graduate and

undergraduate students could be because of differences in financial status. In general, we were able to analyze expectations and experiences with search platforms from our sample, along with what both undergraduate and graduate students would like to see from off-campus housing search platforms and their housing preferences.

Methods

Target Population and Sample Collection

Our target population consists of Carnegie Mellon University undergraduate and graduate students on the Pittsburgh campus. In particular, the target population is CMU students who have searched, are searching, or could potentially be interested in searching for off-campus housing. We are limiting the population to only those who have searched or might search for off-campus housing because those who are not interested in searching for off-campus housing will not give us the answers we want about the preferences and difficulties of the off-campus housing search. In order to target this specific population, the first question of the survey asks respondents if they live off-campus or would consider living off-campus. If a respondent says no to both, they are immediately taken to the end of the survey.

Our sampling frame is undergraduate and graduate students listed in the Carnegie Mellon C-Book. Our sampling frame might be slightly different from our target population, as we are not able to check if all students are included in the C-Book, and not all students in the C-Book reside on CMU's Pittsburgh campus. To ensure the randomness of the sample, we generated series of three random numbers using R. The first number corresponded with the page number of the C-Book, the second with the column, and the third with the name in that column. A range was selected for the third number such that every name on the page had an equal chance of being selected.

We used stratified random sampling, breaking undergraduate and graduate students into two strata. We decided not to break down the undergraduate student population by year, as undergraduates have similar off-campus housing options, preferences, and means of finding off-campus housing. Even current freshmen, who are required to live on campus, have the same options as upperclassmen when searching for their next housing option, which is the focus of our survey. In addition, since the survey is sent during the housing search period, all students have had the opportunity to look into the off-campus search process, which makes them similar for the purposed of our survey. However, there are many differences in what undergraduate and graduate students are looking for in off-campus housing and how they go about looking for such housing. The first difference is that undergraduate students can choose to live on or off-campus, while graduate students are required to find off-campus housing. Undergraduate and graduate students also tend to be in different financial situations. Additionally, undergraduate students and graduate students may look for different features in an off-campus house or apartment.

We manually found our sample by going through the C-Book with our list of random numbers and writing down each selected person's andrewID. There was potential for slight error in our sampling method due to human error in finding the correct name in the C-Book and writing

down the correct andrewID. With a margin of error of 0.08 for each stratum, we determined we should have a sample size of 147 undergraduate students and 109 graduate students (see Appendix B).

We calculated the sample size as follows: we chose the question, "When looking for a place to live off-campus, which method would you be most likely to use or which method have you used the most?" This question has four choices: "Housing and Dining / housing fair," "Craigslist or other online agents," "word-of-mouth," and "other." We believe that Craigslist and other online agents will be the most popular response, based on a small group survey. Therefore, we chose to code this problem as a yes / no type question, where "yes" would be coded as using Craigslist or online sources, and "no" would be coded as using any of the other three choices. For the undergraduate strata, we set the probability of "yes" equal to 0.5, based on our small group survey. For the graduate strata, we set the probability of "yes" equal to 0.75, as graduate students, particularly first year graduate students, might be new to the area and have less access to the other options, like word-of-mouth. From the CMU Factbook, we found that there are 5,843 CMU undergraduate students and 5,670 CMU graduate students (excluding branch campus students). Based on the calculations below, we decided that the largest reasonable sample sizes are 147 undergraduate students and 109 graduate students, based on a margin of error of 0.08 calculated separately for each sample (see Appendix B).

Assuming a response rate of 25%, we planned to take a random sample of 588 undergraduate students and 436 graduate students (147*4 = 588 undergraduate students and 109*4 = 436 graduate students). From sampling using the C-book we obtained a sample of 419 undergraduate students and 318 graduate students, for a total of 737 students. Our calculated sample size and selected sample size varied due to sampling errors. For example, not all columns on every page had the same number of students listed, so there were some lists of randomly generated numbers that did not correspond with a student's name.

Next, we emailed the randomly selected respondents a notification that they were selected to enter the survey (see Appendix C). This notification included a description of the survey and stated its purpose, raffle prize information and appropriate information such as privacy protection and respondents' right to not respond the survey (see Appendix C). To incentivize our respondents, we are giving out two iPod touches through a raffle. We designed the raffle to maintain confidentiality. After taking the survey, the respondent is given an ID number and key. Once the survey is closed we will randomly generate two of the ID numbers. We will email our random sample with the winning ID numbers, and the winners must respond via email with the key to claim to prize.

The link to the survey was sent in a second email and in a follow up email sent out a week later (see Appendix C). Survey takers were able to click on the link, which took them to the survey homepage (see Appendix F). From the homepage, respondents were able to begin the survey. The survey itself was pretested on 11 students and amended based on the comments received. 188 students from our sample responded to the email. Of these, 14 did not complete the survey and did not specify their class. In total, 88 undergraduate and 82 graduate students out of the 737 sampled completed the survey, for a response rate of 23.1% (21.0% for undergraduate and 25.8% for graduate).

Questionnaire

The questionnaire is divided into 4 main sections. These sections are divided to accurately capture the response that we wish to measure. The structure of the questionnaire is as follows:

- Resident status
- Demographic information
- Difficulties of off-campus housing search
- Preferences of off-campus housing search

On the website, the first set of questions is about interest in off-campus housing and where people currently live. For example, by having questions like, "Do you currently reside in campus housing?" and, "Would you consider moving into non-campus housing?" we were able to filter out students not of interest to our study. For the survey, we are not looking at the results from those who are not interested in off-campus housing. Therefore, these introductory questions will enable us to get the data we would like.

Afterwards, there is a general information section. From this section, we will be able to see if our target population is represented. We are especially looking for an accurate representation of undergraduate and graduate students, as we are interested in different attitudes between undergraduates and graduates towards the off-campus housing search.

After asking for demographic information, we looked at which platforms are most used by students. These sets of questions then lead to asking which attributes of the platforms elicit the highest satisfaction. To obtain these results we asked questions like, "For the above method that you chose above, please rate that method according to the following attributes."

The next response section dealt with different housing features that survey takers thought were important. The specific question that we have is, "How important are the following things in affecting your decision to choose a particular house or apartment?" (see Appendix D). We argue that this will enable people to better categorize their preferences and important features. We will be able to see which and what is the most important factor that people consider. Overall, the survey questionnaire is designed not to be boring but to be engaging and to make people think back on their own housing search. The results of this questionnaire will shed light on the important aspects of off-campus housing and the proportion of people looking for it.

We did not use any identifiers when collecting data from respondents. However, since participants took our survey in the location of their choosing, it was up to the participants to ensure their privacy while responding. Data was collected through the use of an online survey, hosted on ZhiJun's team member's website, franscape.com. The raw data we collect is stored online and can only be accessed by our group members and the SURG team. Since identifiers were not used, we do not disclose any of the respondents' information.

Post Survey Processing

Based on our responses, we decided not use post sampling weights. The undergraduate and graduate proportions were only slightly different from our target population. Therefore, we

chose not to weight undergraduates and graduates. We believe there to be great discrepancies between undergraduate and graduate students in housing choices and preferences. We are also only looking for general trends within these two groups, and therefore decided not to weight based on other factors like year and gender.

For the non-response rate, we have different instances of non-response. There are those who never responded to the survey e-mail. There are also those who went to the survey website but decided against taking the survey. Lastly, we have those who did not complete the survey. We had an overall non-response rate of 25.5%. We were not able to measure the exact number of those who went to the survey but did not take the survey. Regarding those who started the survey but did not finish, only 90% of our respondents completed the entire survey.

Results

*All figures can be found in Appendix E

Our research focused on CMU students' searching experiences for off-campus housing. Specifically, we were interested in identifying the deficiencies in the existing search platforms and students' preferences when searching for off-campus housing. To identify the deficiencies, we examined the associations between students' satisfaction versus types of searching platforms and their attributes. Additionally, to identify the preferences, we summarized the types of residencies of interest.

As mentioned in the method section, we divided the subjects of this study into two strata, undergraduates and graduates. The results, in fact, showed that undergraduates and graduates are very different groups. Note that the number of students who have searched for off-campus housing varies tremendously between undergraduates and graduates. Of the 88 responses we received from undergraduates, only 45 have had searching experience. Meanwhile of the 82 responses we received from graduates, 77 have searched. For the undergraduate stratum, since the stratum is divided almost equally between the group with searching experience and that without, we approached this stratum differently than the graduate stratum. We compared the expected rating of search platforms by students who have not searched to the actual rating by students who have searched. Hence, we could see how the searching experience could affect students' rating on the platforms. As for the graduate stratum, we are interested in the relationship between the satisfaction of their searching experience and the platforms they used. Due to this difference in nature between undergraduates and graduates, we continued to separate the two groups in post survey analysis.

Satisfaction vs. Platforms

For students who have searched for off-campus residencies, we would like to know whether satisfaction level differs between search platforms.

Figure 1 is a conditional boxplot on the satisfaction level by search platforms, Housing and Dining Services (hsd), online, word-of-mouth (word), and other (not specified due to technical difficulties) of undergraduate students and graduate students. We see that Housing and Dining

Services yields a lower satisfaction level for both undergraduate and graduate students. Specifically, for graduate students, the median is 2 and the range of the box plot shifts down by 1, compared to the rest of the platforms. For both undergraduates and graduates, word-of-mouth gives the greatest median satisfaction of 4. We observe that graduate students seem to have a higher satisfaction with platforms including online and word-of-mouth than undergraduate students, and lower satisfaction with Housing and Dining Services than undergraduate students.

To verify whether there is a significant difference between the platforms, we conduct a Tukey Multiple Comparisons of Means test for both groups. This test will show us if the difference of satisfaction level between any two platforms is significantly different from zero. Our research hypothesis is summarized below.

Null Hypothesis: mean difference between any of the platforms is zero.
Alternative Hypothesis: at least one of the differences is different from zero.

As shown in Figure 2, if we look at undergraduate and graduate separately, none of the platforms give a significantly higher expected satisfaction than other platforms on a 95% confidence level. This is not surprising since most of the graduate students searched online and the other platforms have relatively fewer responses. For undergraduate students, since less people have searched online, the Tukey 95% confidence intervals are wider, but generally follow a similar trend as for graduate students.

Graduate Students: Satisfaction vs. Attributes of Searching Platform

After examining the satisfaction with respect to specific platform, we then look at the association between satisfaction and attributes of each platform. We include four attributes: accessibility, adequacy, accuracy, and likelihood of success.

From Figure 3, we are not surprised to see that all the attributes are positively correlated with satisfaction. However, the correlation is not very strong. The highest correlation coefficient is only 0.49 for adequacy and the second is 0.43 for accuracy. We can also see there is an issue of multicollinearity between the attributes, especially between accuracy and adequacy (r=0.65). Despite the multicollinearity in the preliminary data, we ran two regressions.

As seen in Figure 4, we ran regressions on the four attributes against satisfaction. Adequacy is significant in predicting satisfaction (at an alpha level of 0.001) and the coefficient is 0.41. But surprisingly, the coefficient of accessibility is -0.09292, meaning as accessibility level increases by 1, the level of satisfaction decreases by 0.09292. A valid interpretation can be that the less accessible platforms provide higher satisfaction level. As you can see in Figure 6 hsd is highly accessible but the overall satisfaction is low. On the other hand, online searching is less accessible but provides more satisfaction. However, we have relatively few responses with hsd, so the results may not be as accurate. You can see that the adjusted R-squared is only 27.51%.

We then included the variable platform in the second output, Figure 5. We used the platform category “online” as a reference group because it is the largest group. As we observe in this output, adequacy remained significant. However, the adjusted R-squared decreases slightly.

Regardless of the R-squared for both regressions, adequacy of the information remained an important attribute in graduate students' search for off-campus housing. From the previous section, we showed that "none of platforms gives a significantly higher expected satisfaction than other platforms on a 95% confidence level." However, in this section, we can see that attributes of platforms help explain the level of satisfaction.

Undergraduate Students: Expectation of Searching Experience

For undergraduate students, we are interested in how the expectation of searching experience differs from reality. For people who are interested in off-campus housing, but have not searched yet, we look at what platforms they would most likely choose and how they consider those platforms.

Most undergraduate students with no experience searching for off-campus housing tend to choose online (38.9%) as the primary information sources, followed by Housing and Dining (29.5%) and word-of-mouth (29.5%). From the boxplots in Figure 7, we see that people seem to consider word-of-mouth and online platforms most accessible. Housing and Dining is considered to provide the most adequate and accurate information. Students consider Housing and Dining and online platforms most likely to succeed.

Undergraduate students who have not searched for off-campus housing yet seem to have a very high expectation from Housing and Dining. However, students who have searched before indicate relatively low satisfaction with Housing and Dining.

Summary of Preferences

We continued to look at students' preferences in other aspects of off-campus housing (see Figure 10). We found that both undergraduates and graduates prefer an apartment to a house. A possible reason is that apartments are more convenient and easier to clean up (i.e. it is usually smaller than a house and tenants have less responsibility during trash days). Also, we found that undergraduates are more likely to share a residence than graduates. We can give three possible explanations. Since undergraduates must live in a dorm during freshman year and graduates are never provided with on campus housing, undergraduates tend to be better connected. Another possibility is that graduate students are older and more likely to have family and, therefore, enjoy more privacy. Finally, since graduates usually have higher income than undergraduates, they are more likely to be able to afford to live alone. The difference in income is also reflected in the average travel time and average monthly rent. Graduate students are willing to live 20 minutes (walking time) away from campus, which is 5 minutes more than undergraduates. Graduates are also willing to pay higher rent on average, from a range of $375 to $696, while undergraduates are willing to pay between $287 and $582. As for the method of payment, both undergraduates and graduates prefer to pay online.

Likelihood of Success vs. Preferences

We were also interested in the relationship between what type of housing students are looking for and the relevant likelihood of success. Here, we use likelihood of success as the primary

variable of interest, and used people's preference variables, sharecheck and rescheck as predictors. Sharecheck is a categorical variable that records whether people want to live alone or share a housing unit with others. Rescheck is a categorical variable that records whether people are looking for an apartment or a house. In this part, we only look at students who have searched before, since an assumed likelihood of success would not give us valuable information. We look at the undergraduate and graduate samples separately.

In Figure 8, we observe that undergraduate students who wish to live alone indicate a higher likelihood of successful in the housing search. In addition, undergraduate students who are looking for houses have a higher likelihood of success than those who are looking for apartments. However, as we can see in the summary of preferences section (Figure 10), more undergraduates prefer apartments to houses, and sharing housing than living alone.

In Figure 9, there appear to be no differences in likelihood of success between graduate students who prefer apartments and those who prefer houses. Graduate students who wish to live alone have a wider range of likelihood ratings than those who wish to share a housing unit. This can be explained by the fact that most of the graduate students prefer to live alone, as can be seen in the summary of preferences (Figure 10).

Section 4: Discussion

Discussion of Research Questions

For this survey, we were looking at two main questions related to the off-campus housing search by Carnegie Mellon University students. First, our survey asked about CMU students' means of searching for off-campus housing, what searching methods students have used, and their experience with such housing search methods. Second, we looked at CMU students' off-campus housing preferences and what students look for when searching for off-campus housing. From our results, we found that all of the search platforms had similar levels of satisfaction. However, we found differences in the effects that different platform attributes had on satisfaction. For undergraduates, online sources were favored and word-of-mouth and online were considered to be the most accessible platforms. For graduates, the highest correlation between satisfaction and a platform attribute was between satisfaction and adequacy. Housing and Dining was the worst method to go about searching for off-campus housing, however, those who had not searched for off-campus housing had high expectation for Housing and Dining. Overall, we found differences among those who have searched for off-campus housing and those who have not. The final summary of the preferences confirms that graduate students and undergraduates are, indeed, very different groups. In general, graduate students are more willing to live alone, pay higher rent, and live further from campus.

Expected and Unexpected Results

As expected, it was useful to stratify our population before sampling. We found that only 45 out of 88 undergraduates have searched for off-campus housing, compared to the much larger

proportion of 77 out of 82 for graduates. With these proportions, it was definitely more useful to treat the strata differently, focusing on the housing search expectations for undergraduates and the search experience for graduates.

The search platform preferences of undergraduates follow our initial expectations. We expected online search platforms to be the most popular and calculated our sample sizes based on this assumption. Our results indicate that undergraduates new to the search process choose to search online first. We also see that undergraduates tend to be disappointed with Housing and Dining despite their initial high expectations of it. This makes sense, as CMU students would expect a CMU service to cater more to their needs, but ultimately Housing and Dining caters mostly to on campus resident life.

It was somewhat unexpected to find that Tukey tests regarding platform satisfaction for both undergraduates and graduates did not show evidence of there being a difference between platforms, at least within each stratum. We had expected that a preference, which could indicate more satisfaction, for a platform would exist, thus allowing us to make individual recommendations by stratum for that platform based on our results.

We had also expected there to be a stronger correlation between the attributes of search platforms and how satisfied students are with using them. Accessibility, adequacy, accuracy, and success with using the search platform should in theory increase one's satisfaction. However, the highest correlation coefficient for any of these four attributes was only found to be 0.49. In fact, we found that the attribute of accessibility even decreases overall satisfaction, leading to results that show lower overall satisfaction for Housing and Dining despite the search platform scoring better than the competition in all attributes. This unusual observation can be explained by multicollinearity between the attributes and possibly by a tendency to equate the accessibility of something with a lower satisfaction with it.

Strengths

We had strengths that helped us decrease error and improve our survey results. First, we were able to decrease non response error through offering an incentive for taking our survey. While we did not achieve as high of a response rate as we had anticipated, we still achieved a response rate of 23.1%. Another strength was that our survey questions were pretested on a diverse group. Following recommendations from our pre-testers, we were able to clarify multiple points in our survey questions so that they could easily be understood by a wide range of audiences. In addition, we were able to modify our survey so that it explored the research question more accurately and completely.

Weaknesses

We had weaknesses mainly in our survey questionnaire and in our sampling method. For the survey, we had a few open response questions. The open response questions were difficult to code, making it difficult to truly capture the respondent's answer. Additionally, respondents were not required to answer every question. Therefore, we had some incomplete surveys that we were unable to use. Our sampling weaknesses came from sampling using the C-book. Although

we generated random numbers using a computer, we built our sample by going through the C-book manually and entering the selected sample's email addresses in a spreadsheet. As we were dealing with a large set of randomly generated numbers, our method of extracting contacts from the book was highly subject to human error. 21 of the email addresses were unable to be found when sending out emails.

Recommendations for Future

Based on our strengths and weaknesses, we have two main recommendations for future groups. First, if taking a sample of the Carnegie Mellon student population, we recommend finding an online or computerized way to obtain the sample. Automating the process of generating a sample will save time, as well as reduce the human error of doing the same task. Second, when working with human samples, researchers should expect delays in constructing and executing their study, relative to studies with non-human objects. Extra effort must be made to ensure that the study is compliant with IRB specifications, and all members of the research team must have completed ethics training from CITI or equivalent programs.

Take-home Messages

Most of the suggestions and results pertain to Housing and Dining in Carnegie Mellon University. This survey would be most useful for Housing and Dining Services to improve its service. As a housing and dining service for Carnegie Mellon University, it is expected to provide the best service in the search for housing both on and off-campus housing for the university's students. From the survey results, it is clear that Housing and Dining is the least satisfactory means to go about searching for off-campus housing. However, an interesting point to note is that Housing and Dining is generally assumed to be the best way to go about searching for off-campus housing. The survey results suggest that something could be done about Housing and Dining Services at Carnegie Mellon University, since it could provide the best service in CMU students find off-campus housing.

In the previous paragraph we talked about how Housing and Dining Services should try to capture more satisfaction from the student body. We saw that people assumed that Housing and Dining would be the most useful tool. As it turns out, once people start using the service it is the least satisfactory option. However, the survey results also show that there is no clear preference for a housing search method. Therefore, if Housing and Dining can provide more information, such as referring a better online platform to search for housing and providing SNS service, where students can interact with each other to share housing information, Housing and Dining can become the best method of searching for off-campus housing.

We also found distinct differences in graduate and undergraduate preferences in off-campus housing. Future studies and analysis could be used to better identify such preferences. For example, it could be studied if there is not just a difference in preferences between graduate and undergraduate students but also differences between majors and years. These preferences can then be used by off-campus search platforms, like Housing and Dinning Services, to provide students with the best housing options that fit their preferences.

Appendix

Appendix A – Bibliography

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Appendix B – Sample Size

According to the CMU Factbook, there are 5,843 CMU undergraduate studens and 5,670 CMU graduate students on the Pittsburgh campus.

Undergraduate Students:

$p = 0.5$

$standard\ deviation = \sqrt{p(1-p)} = 0.5$

$$n' = \frac{(Z_{\alpha/2}^2)(SD^2)}{(ME)^2}$$

$$n' = \frac{(1.96^2)(0.5^2)}{(ME)^2}$$

$$n \geq \frac{(N)(n')}{(N+n')}$$

$$n \geq \frac{(5843)(n')}{(5843+n')}$$

Margin of Error (ME) cases:

$ME = .07$: $n = 189.64 \rightarrow 190$

$ME = .08$: $n = 146.30 \rightarrow 147$

$ME = .09$: $n = 116.20 \rightarrow 117$

Graduate Students

$p = 0.75$

$standard\ deviation = \sqrt{p(1-p)} = 0.43$

$$n' = \frac{(Z_{\alpha/2}^2)(SD^2)}{(ME)^2}$$

$$n' = \frac{(1.96^2)(0.43^2)}{(ME)^2}$$

$$n \geq \frac{(N)(n')}{(N+n')}$$

$$n \geq \frac{(5670)(n')}{(5670+n')}$$

ME cases:

$ME = .07$: $n = 141.34 \rightarrow 142$

$ME = .08$: $n = 108.85 \rightarrow 109$

$ME = .09$: $n = 86.36 \rightarrow 87$

Total:

$ME = .07$: $190 + 142 = 332$

$ME = .08$: $147 + 109 = 256$

$ME = .09$: $117 + 87 = 204$

* We chose ME = .08 for each strata. Assuming equal ME for each strata to be consistent, this is the smallest ME we can have without making our total sample size too large to handle for the scope of this project. In this case, overall ME is not calculated since we are only looking at the strata separately.

Appendix C – Emails and Consent Form

Email 1 (promotional).

Subject: Housing Survey with iPod Touch Raffle

Dear CMU Student,

We are interested in **improving the off-campus housing search** through our project in 36-303, a statistics class.

We have randomly selected undergraduate students and graduate students to help us in **identifying the difficulties and preferences in the off-campus housing search** through an online survey.

Each one of your responses is valuable to us and crucial to our results. **By completing our survey, which takes less than 10 minutes, you will automatically be entered into a raffle to win an *iPod touch***. There will be **two** winners.

You will be receiving the link to the survey via email within next few days. More information concerning the project and the raffle can be found at the following link:
http://promos.franscape.com/houselife/

Thank you,
Jessica Cui (jcui@andrew.cmu.edu)
ZhiJun Huang (zhijunh@andrew.cmu.edu)
Terence Kwak (tkwak@andrew.cmu.edu)
Emily Lee (erlee@andrew.cmu.edu)
Cen Zhou (cenz@andrew.cmu.edu)

Email 2 (with survey).

Dear CMU Student,

As stated in our previous email, we are interested in improving the off-campus housing search for our project in a statistics class, 36-303.

To ensure the success of this project, we need your help in filling out the following survey: http://promos.franscape.com/houselife/

By completing our survey, which takes less than 10 minutes, you will automatically be entered into a raffle to win an **iPod touch.** There will be two winners who will be announced in the next two weeks.

If you have any questions or concerns about the survey, please feel free to contact us via email.

Thank you,
Jessica Cui (jcui@andrew.cmu.edu)
ZhiJun Huang (zhijunh@andrew.cmu.edu)
Terence Kwak (tkwak@andrew.cmu.edu)
Emily Lee (erlee@andrew.cmu.edu)
Cen Zhou (cenz@andrew.cmu.edu)

Email 3 (follow up email).

Dear CMU Student,

Thank you for those who have completed the Off-Campus Housing Survey. Your contribution means a lot to us!

For those who have not completed the survey, the survey will be closed in less than one week (INSERT DATE). The link to the survey is as follows:
http://promos.franscape.com/houselife/

As a reminder, you have a chance to win an iPod touch upon the completion of the survey.

Thank you for your time!

With much appreciation,

Jessica Cui (jcui@andrew.cmu.edu)
ZhiJun Huang (zhijunh@andrew.cmu.edu)
Terence Kwak (tkwak@andrew.cmu.edu)
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Consent form.

This survey is intended to identify existing difficulties and preferences in off-campus search among college students in Pittsburgh. Ultimately, from the survey, we wish to find possible ways to improve the off-campus housing search process.

The selected participants will be provided the link for the survey. The survey should take less than 10 minutes. After the completion of the survey, the respondent is entered into a raffle for the chance to win an iPod touch. There will be two iPod touches given to two different winners of the raffle. The raffle will be a fair and random drawing.

Refusal or discontinuation of the survey will only take away the opportunity to enter the raffle. However, entitlement to other rights or privileges remains the same.

After sending the survey link to the sampled group, the survey will be completely anonymous and conducted on an external website. No personal information will be extracted and all sensitive information will be kept confidential. See further details and specifications at (INSERT LINK).

If you have any questions concerning the study or confidentiality, please contact us via the following emails:

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Appendix D – Questionnaire: complete version available at http://promos.franscape.com/houselife/

Part 0: Introduction

0.1. Which Pittsburgh university do you belong to? Choose.

0.2. Please specify your home zip code.

0.3. Do you currently reside in campus housing? (i.e., anything that requires a university housing contract, whether physically on- or off-campus) yes no

Next

Part 1: General Information

1.1. What is your gender? male female other

1.2. Please specify your ethnicity. Choose.

1.3. Please specify your level of academic study undergrad masters doctoral

1.4. Please specify your year of academic study Choose.

1.5.1. Do you hold an international student VISA? yes no

1.6. Do you have regular access to a car in Pittsburgh? yes no

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Part 2: Housing Search Discussion

2.1. Have you tried searching for off-campus housing? yes no

When looking for a place to live off-campus, which method have you used the most? Choose.

For the above method that you chose above, please rate that method according to the following attributes (1 = "disagree strongly", 5 = "agree strongly").

It was easy to use/accessible.	1	2	3	4	5
It provided adequate information.	1	2	3	4	5
It provided accurate information.	1	2	3	4	5
I successfully found residence.	1	2	3	4	5

How would you rate your overall experience of searching off-campus housing? (1 = "awful", 5 = "awesome"). 1 2 3 4 5

What are some other features you would look for in a website that specializes in the housing search process?

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Part 3: Desired Housing Attributes

Which of the following do you prefer to live in?	**house**	**apartment**		
Would you prefer to live by yourself or share the residence with others?	**alone**	**shared**		
Which of the following do you prefer to live with?	**Friends**	**Acquaintances**	**Unfamiliar people**	**Don't care**
Ideally, how many other people would you prefer to share the residence with?				
Would you prefer to share a room with a roommate or have a single?	**Shared**	**Single**	**Don't care**	
If you decided to look for off-campus housing, up to how much are you willing to pay for an off-campus housing per month?	**$**	**to $**		
What is your preferred means of monthly rent payment?	**Cash**	**Check**	**Credit Card**	
What is your preferred method of monthly rent payment?	**Mail**	**Online**	**In-person**	

Previous **Submit**

Appendix E – Results: Graphs/Outputs/Tables

Figure 1: Boxplot: Satisfaction by Class Level

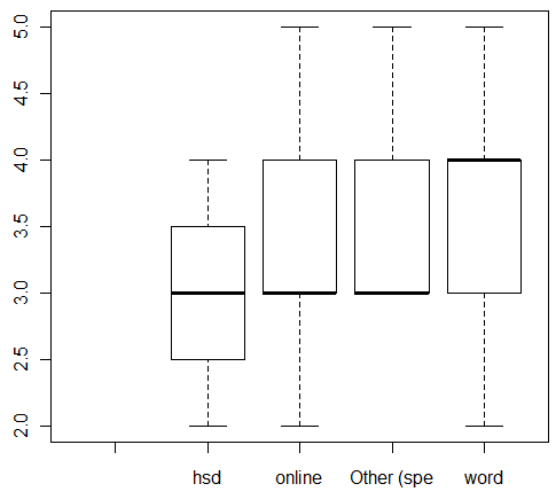
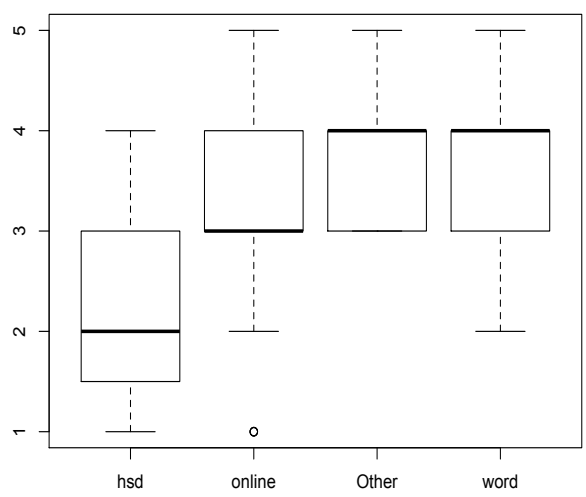
Undergraduate	Graduate
	

Figure 2: Difference in Mean Satisfaction by Platform

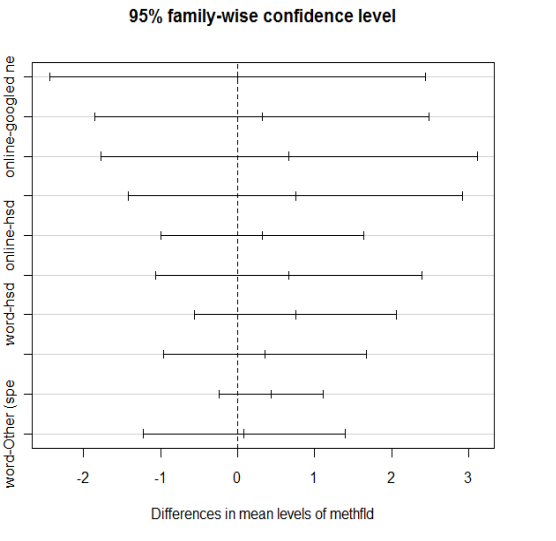
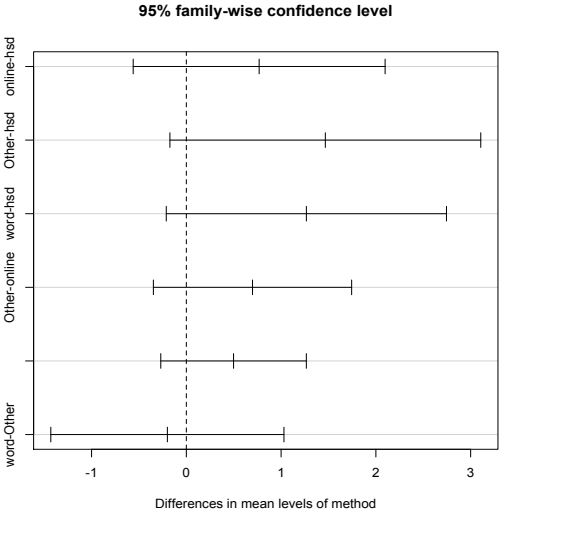
Undergraduate	Graduate
	

Figure 3: Satisfaction vs Attributes of Searching Platform (Graduate)

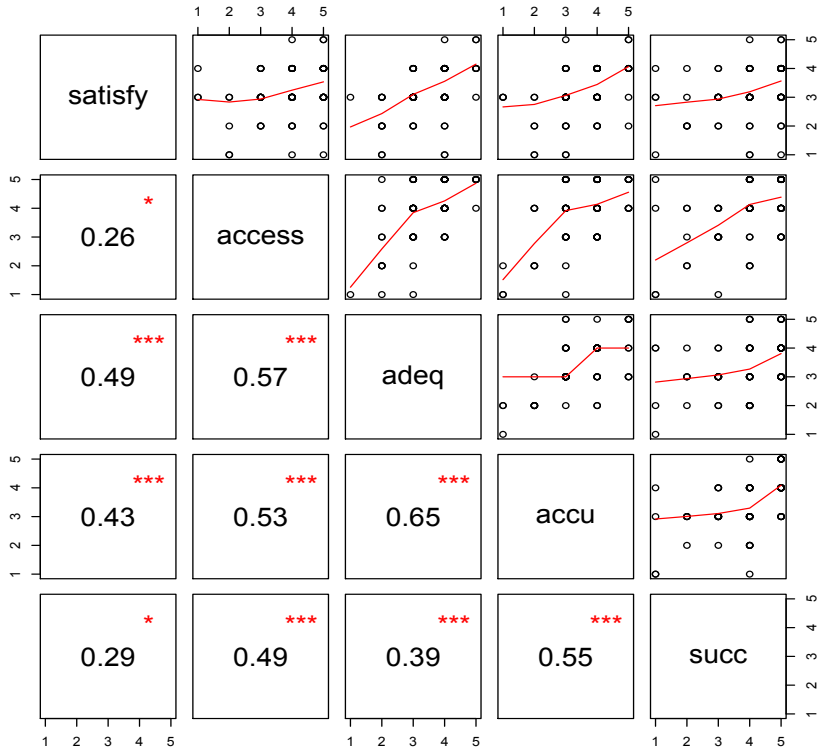


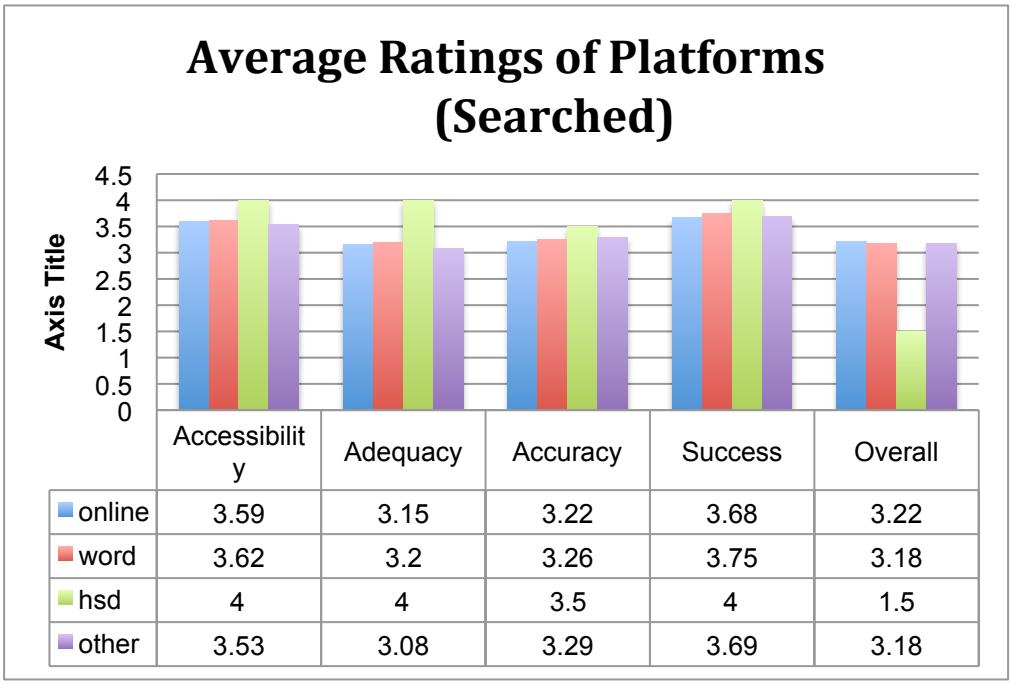
Figure 4: Satisfaction vs Four Attributes Output

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.28459    0.41668   3.083  0.00291 **
access      -0.09292    0.10996  -0.845  0.40090
adeq         0.41110    0.14190   2.897  0.00499 **
accu         0.16732    0.13753   1.217  0.22773
succ         0.06834    0.09673   0.706  0.48218
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.7737 on 72 degrees of freedom
Multiple R-squared: 0.2751, Adjusted R-squared: 0.2348
F-statistic: 6.831 on 4 and 72 DF,  p-value: 0.0001017
```

Figure 5: Satisfaction vs Four Attributes and Platforms Output

```
Coefficients: (1 not defined because of singularities)
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.37451    0.41291   3.329  0.00139 **
access      -0.15256    0.11080  -1.377  0.17295
adeq         0.47153    0.14669   3.214  0.00198 **
accu         0.15649    0.13429   1.165  0.24785
succ         0.07211    0.09459   0.762  0.44838
word         0.00533    0.27189   0.020  0.98442
hsd         -1.09851    0.46308  -2.372  0.02043 *
other             NA         NA      NA       NA
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.7544 on 70 degrees of freedom
Multiple R-squared: 0.3299, Adjusted R-squared: 0.2725
F-statistic: 5.745 on 6 and 70 DF,  p-value: 6.656e-05
```

Figure 6: Average Rating of Platforms (Graduate)



	Accessibility	Adequacy	Accuracy	Success	Overall
online	3.59	3.15	3.22	3.68	3.22
word	3.62	3.2	3.26	3.75	3.18
hsd	4	4	3.5	4	1.5
other	3.53	3.08	3.29	3.69	3.18

Figure 7: Undergraduate Expectations of Searching Experience

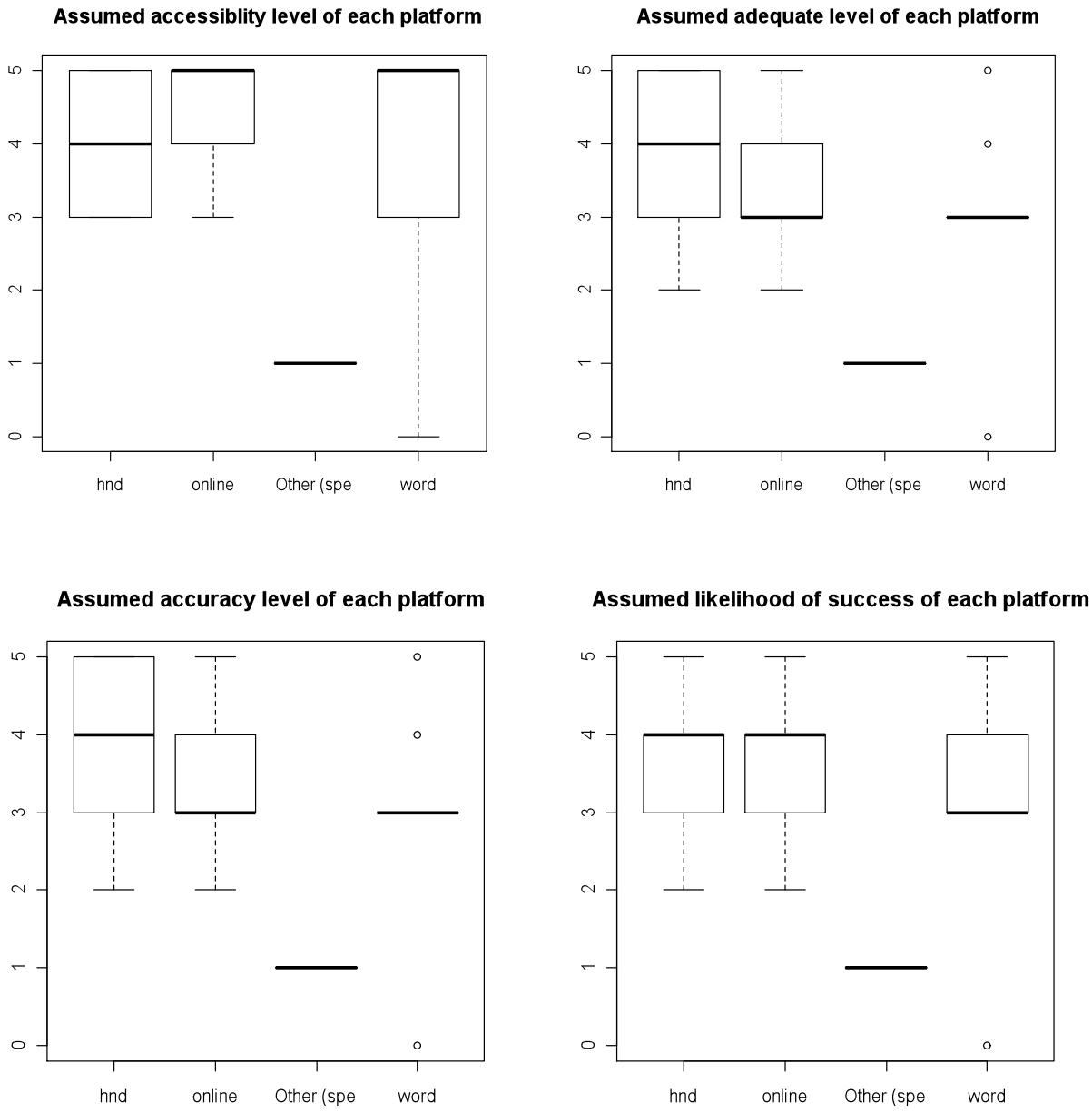


Figure 8: Undergraduate Likelihood of Success vs Preferences (Sharecheck, Type of Housing)

Figure 9: Graduate Likelihood of Success vs Preferences (Sharecheck, Type of Housing)

Figure 10: Preferences

	Graduate	Undergraduate
Apartment	72%	54%
House	28%	46%
Live Alone	53%	20%
Share	47%	80%
Average Walking Time	20 minutes	15 minutes
Average Monthly Rent (min, max)	($375,$696)	($287, $582)
Online Payment Preferred	67%	79%

Figure 11: Demographics: Undergraduate

Current Residency	
Off-campus Housing	29.5%
On-campus Housing	70.4%
Gender	
Female	55.7%
Male	42.0%
Other	2.3%
Ethnicity	
African American	5.7%
Asian	42.0%
Caucasian	37.5%
Hispanic	4.5%
Other	10.0%
Asian/Caucasian	2.3%
African American/Caucasian	1.1%
Hispanic/Caucasian	1.1%
Indian	1.1%
Swedish/Pakistani	1.1%
Grade	
Freshman	29.5%
Sophomore	29.5%
Junior	22.7%
Senior	15.9%
Fifth	2.3%
Visa Status	
U.S. students	85.2%
International Students	14.8%
Access to Car	
Yes	14.8%
No	85.2%
Experience of searching off-campus Housing	
Yes	51.1%
No	48.9%
Platform most likely to choose	
Housing and Dining	14.7%
Online	19.3%
Word-of-mouth	14.7%
Other	1.1%

Figure 12: Demographics: Graduate

Current Residency	
Off-campus Housing	98.8%
On-campus Housing	1.2%
Gender	
Female	41.5%
Male	57.3%
Other	1.2%
Ethnicity	
African American	4.9%
Asian	39.0%
Caucasian	49.2%
Hispanic	7.3%
Other	3.6%
Asian/Caucasian	1.2%
Indian	2.4%
Class Level	
Doctoral	36.6%
Masters	63.4%
Visa Status	
U.S. students	54.9%
International Students	45.1%
Access to Car	
Yes	61.0%
No	39.0%
Experience of searching off-campus Housing	
Yes	93.9%
No	6.1%
Platform used or most likely to use	
Housing and Dining	
Online	3.7%
Word-of-mouth	75.6%
Other	14.6%
	6.1%

Appendix F – Screenshot of Website