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Evolution of the Investigator Satisfaction Ranking Report: The Advantage of Using the “PROC REPORT Procedure/ODS Excel” versus a “CROSSTAB Output” or “CROSSTAB/ODS Excel”

Mollie Van Loon, CSIS Project, Pennsylvania State University, University Park, PA
John Shingler, CSIS Project, Pennsylvania State University, University Park, PA

ABSTRACT

This paper describes the evolution of the SAS® programming of a report used in employee evaluations by a government agency. The data is taken from a survey seeking customers' opinion of the service they received from the agency. We entered the data into a SAS dataset and developed a ranking for each employee. The agency requires the final report to be in Excel. When we began processing the report, the programming was written in SAS Version 6. The report was derived from a CROSSTAB output .LST file and typed into an Excel table. With SAS Version 8, we were able to output the CROSSTAB table into an Excel file using ODS. Although the results were in Excel, they still required much editing. Thus, the first two versions were both time consuming and error prone. To resolve these issues, we changed the SAS programming and used PROC REPORT and ODS statements. This last evolution of SAS programming allows us to produce the report in nearly final format and with a lower potential for introducing error.

INTRODUCTION

Many agencies seek ways to incorporate client satisfaction into their employee evaluation process. This paper uses the Investigator Satisfaction Ranking Report that we developed for a government agency to illustrate how we use SAS to generate information included in employee evaluations. The agency mediates and investigates complaints between customers and utility companies. We were asked to produce a report showing the ranking of investigators' performance based on customer satisfaction with the complaint resolution process.

The data used to assess an investigator's ranking are derived from a weekly survey of customers who have contacted the agency. The results of the weekly customer survey are used for a variety of reports that are run in SAS. A SAS database has given us flexibility in meeting all of the analytical needs of the agency; using the survey results as part of the employee evaluation process has been a recent addition to our reporting process.

In the survey, customers are asked to provide their opinion on the service they received when their complaint was investigated by the agency. Customers rate their overall satisfaction with the service based on the following four-point scale: “Poor”, “Fair”, “Good” or “Excellent”. The returned surveys are matched to the investigator who provided the service, from which we develop a ranking of approximately one hundred investigators in terms of satisfaction with the service they provided.

The data from each completed survey is entered into a SAS database. Although it is possible to run reports off this database and copy the SAS .LST files into a MS Word Document, the agency requires the results for this Ranking Report be sent to them in an Excel table.

In this paper we describe the evolution of the Investigator Satisfaction Ranking Report in terms of three methods used to generate the report – (1) CROSSTAB Output, (2) CROSSTAB Output and ODS Excel Statements, and (3) PROC REPORT and ODS Excel Statements.

METHOD 1: CROSSTAB OUTPUT

When we initially started processing the Ranking Report, we ran the results using a CROSSTAB table showing investigators by satisfaction. The results from the SAS .LST file were then typed into an Excel table by hand. The final report table was produced in the same Excel file, and it included the number of cases within each category of service rating, the percentage of cases within each category, the total “N”, and an overall ranking for each investigator. The ranking is calculated for each investigator by assigning a point value to each rating category, multiplying the point value by the total number of cases in the corresponding category, adding up the multipliers and dividing by the total number of cases. See formula below:

Formula: $((\text{Poor } N \times 1) + (\text{Fair } N \times 2) + (\text{Good } N \times 3) + (\text{Excellent } N \times 4)) / \text{Total } N$

PROGRAMMING FOR METHOD 1

```

PROC FREQ ORDER=INTERNAL;
WHERE MAILYEAR=2007 AND MAIL=1 AND UNIT IN (1 4 7 9);
TABLE INVEST * RATE / NOCOL NOPERCENT;
RUN;

```

RESULTS FOR METHOD 1

The SAS System

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The FREQ Procedure

Table of INVEST by RATE

INVEST(Investigator) RATE(PUC RATING)

| Frequency Row Pct | POOR | FAIR | GOOD | EXCELLEN T | Total |
|----------------------|------------|------------|------------|---------------|-------|
| OAK | 0 0.00 | 3 33.33 | 2 22.22 | 4 44.44 | 9 |
| WILLOW | 0 0.00 | 2 7.14 | 8 28.57 | 18 64.29 | 28 |
| DOGWOOD | 5 20.00 | 3 12.00 | 5 20.00 | 12 48.00 | 25 |
| LINDEN | 1 5.00 | 5 25.00 | 6 30.00 | 8 40.00 | 20 |
| JUNIPER | 1 3.45 | 2 6.90 | 8 27.59 | 18 62.07 | 29 |
| ELM | 0 0.00 | 2 6.06 | 8 24.24 | 23 69.70 | 33 |
| MAPLE | 4 17.39 | 2 8.70 | 6 26.09 | 11 47.83 | 23 |
| ASPEN | 6 13.64 | 9 20.45 | 9 20.45 | 20 45.45 | 44 |
| PINE | 2 5.88 | 8 23.53 | 4 11.76 | 20 58.82 | 34 |
| BIRCH | 4 18.18 | 4 18.18 | 5 22.73 | 9 40.91 | 22 |
| Total | 23 | 40 | 61 | 143 | 267 |

FINAL TABLE FOR METHOD 1

| Satisfaction Ranking for Investigators - Crosstab Programming | | | | | | | | | | | | | |
|---|-------|---|-------|---|-------|---|-----------|----|-------|-------------------|------|--|--|
| Rating of Service | | | | | | | | | | | | | |
| Investigator | POOR | | FAIR | | GOOD | | EXCELLENT | | TOTAL | (Ranking Formula) | RANK | | |
| | % | N | % | N | % | N | % | N | | | | | |
| ELM | 0 | 0 | 6.06 | 2 | 24.24 | 8 | 69.7 | 23 | 33 | 3.64 | 3.64 | | |
| WILLOW | 0 | 0 | 7.14 | 2 | 28.57 | 8 | 64.29 | 18 | 28 | 3.57 | 3.57 | | |
| JUNIPER | 3.45 | 1 | 6.9 | 2 | 27.59 | 8 | 62.07 | 18 | 29 | 3.48 | 3.48 | | |
| PINE | 5.88 | 2 | 23.53 | 8 | 11.76 | 4 | 58.82 | 20 | 34 | 3.24 | 3.24 | | |
| OAK | 0 | 0 | 33.33 | 3 | 22.22 | 2 | 44.44 | 4 | 9 | 3.11 | 3.11 | | |
| LINDEN | 5 | 1 | 25 | 5 | 30 | 6 | 40 | 8 | 20 | 3.05 | 3.05 | | |
| MAPLE | 17.39 | 4 | 8.7 | 2 | 26.09 | 6 | 47.83 | 11 | 23 | 3.04 | 3.04 | | |
| ASPEN | 13.64 | 6 | 20.45 | 9 | 20.45 | 9 | 45.45 | 20 | 44 | 2.98 | 2.98 | | |
| DOGWOOD | 20 | 5 | 12 | 3 | 20 | 5 | 48 | 12 | 25 | 2.96 | 2.96 | | |
| BIRCH | 18.18 | 4 | 18.18 | 4 | 22.73 | 5 | 40.91 | 9 | 22 | 2.86 | 2.86 | | |

Note: Table generated from "Original Crosstab Programming Output".

DISADVANTAGES OF METHOD 1

There are two problems with the basic CROSSTAB Output method:

1. Generating the Ranking Report using a CROSSTAB statement is time-consuming because it requires creating the report in an Excel table by hand. The frequencies and percentages within each category of rating were typed into the Excel table for each investigator. After the data was typed into the table, the overall satisfaction ranking was calculated for each investigator by typing in the appropriate formula for the first investigator and copying it over for the remaining investigators. The entire table was re-sorted by descending rank so the investigator with the highest rank appeared at the top of the table. Titles and column labels were added to the table before the final version was sent to the agency.

2. Since the Excel table is created manually, the potential to introduce error into the results is very high.

METHOD 2: CROSSTAB/ODS EXCEL

A second processing approach for compiling the Ranking Report arose after the introduction of the ODS procedure in SAS. We were able to simplify half of the processing by having the results output directly into an Excel table. The CROSSTAB procedure was used again, but to produce two separate tables within ODS statements: (1) investigator by rating, limiting the output to only "Ns", and (2) investigator by rating, limiting the output to only "row percentages". The Excel table is edited into its final format which includes the number of cases within each category of service rating, the percentage of cases within each category, the total "N" and an overall ranking for each investigator.

PROGRAMMING FOR METHOD 2

```
ODS XML FILE="I:\PEOPLE\MOLLIE\SUGI 2009\CROSSTAB-ODSEXCEL.XLS" TYPE=CSVALL;
TITLE1 'SATISFACTION RANKING FOR INVESTIGATORS - CROSSTAB-ODS EXCEL PROGRAMMING';
PROC FREQ ORDER=INTERNAL;
WHERE MAILYEAR=2007 AND MAIL=1 AND UNIT IN (1 4 7 9);
TABLE INVEST * RATE / NOCOL NOROW NOPERCENT;
RUN;

PROC FREQ ORDER=INTERNAL;
WHERE MAILYEAR=2007 AND MAIL=1 AND UNIT IN (1 4 7 9);
TABLE INVEST * RATE / NOFREQ NOCOL NOPERCENT;
RUN;
ODS XML CLOSE;
```

RESULTS FOR METHOD 2

Microsoft Excel - CROSSTAB-ODS EXCEL.XLS

File Edit View Insert Format Tools Data Window Help Adobe PDF Type a question for help

L14 fx

| | A | B | C | D | E | F | G | H | I | J | |
|----|---|-------|-------|-------|-----------|-------|---|---|---|---|--|
| 1 | SATISFACTION RANKING FOR INVESTIGATORS - CROSSTAB-ODS EXCEL PROGRAMMING | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | The FREQ Procedure | | | | | | | | | | |
| 4 | Frequency | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | Table of INVEST by RATE | | | | | | | | | | |
| 7 | INVEST("I" RATE(PUC RATING)) | | | | | Total | | | | | |
| 8 | | POOR | FAIR | GOOD | EXCELLENT | | | | | | |
| 9 | OAK | 0 | 3 | 2 | 4 | 9 | | | | | |
| 10 | WILLOW | 0 | 2 | 8 | 18 | 28 | | | | | |
| 11 | DOGWOOD | 5 | 3 | 5 | 12 | 25 | | | | | |
| 12 | LINDEN | 1 | 5 | 6 | 8 | 20 | | | | | |
| 13 | JUNIPER | 1 | 2 | 8 | 18 | 29 | | | | | |
| 14 | ELM | 0 | 2 | 8 | 23 | 33 | | | | | |
| 15 | MAPLE | 4 | 2 | 6 | 11 | 23 | | | | | |
| 16 | ASPEN | 6 | 9 | 9 | 20 | 44 | | | | | |
| 17 | PINE | 2 | 8 | 4 | 20 | 34 | | | | | |
| 18 | BIRCH | 4 | 4 | 5 | 9 | 22 | | | | | |
| 19 | Total | 23 | 40 | 61 | 143 | 267 | | | | | |
| 20 | | | | | | | | | | | |
| 21 | SATISFACTION RANKING FOR INVESTIGATORS - CROSSTAB-ODS EXCEL PROGRAMMING | | | | | | | | | | |
| 22 | | | | | | | | | | | |
| 23 | The FREQ Procedure | | | | | | | | | | |
| 24 | Row Pct | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 26 | Table of INVEST by RATE | | | | | | | | | | |
| 27 | INVEST("I" RATE(PUC RATING)) | | | | | Total | | | | | |
| 28 | | POOR | FAIR | GOOD | EXCELLENT | | | | | | |
| 29 | OAK | 0 | 33.33 | 22.22 | 44.44 | | | | | | |
| 30 | WILLOW | 0 | 7.14 | 28.57 | 64.29 | | | | | | |
| 31 | DOGWOOD | 20 | 12 | 20 | 48 | | | | | | |
| 32 | LINDEN | 5 | 25 | 30 | 40 | | | | | | |
| 33 | JUNIPER | 3.45 | 6.9 | 27.59 | 62.07 | | | | | | |
| 34 | ELM | 0 | 6.06 | 24.24 | 69.7 | | | | | | |
| 35 | MAPLE | 17.39 | 8.7 | 26.09 | 47.83 | | | | | | |
| 36 | ASPEN | 13.64 | 20.45 | 20.45 | 45.45 | | | | | | |
| 37 | PINE | 5.88 | 23.53 | 11.76 | 58.82 | | | | | | |
| 38 | BIRCH | 18.18 | 18.18 | 22.73 | 40.91 | | | | | | |
| 39 | Total | 23 | 40 | 61 | 143 | 267 | | | | | |
| 40 | | | | | | | | | | | |

CROSSTAB-ODS EXCEL / NUM

Ready

FINAL TABLE FOR METHOD 2

| INVESTIGATOR | POOR | | FAIR | | GOOD | | EXCELLENT | | TOTAL | (Ranking Formula) | RANK |
|--------------|-------|---|-------|---|-------|---|-----------|----|-------|-------------------|------|
| | % | N | % | N | % | N | % | N | | | |
| ELM | 0 | 0 | 6.06 | 2 | 24.24 | 8 | 69.7 | 23 | 33 | 3.64 | 3.64 |
| WILLOW | 0 | 0 | 7.14 | 2 | 28.57 | 8 | 64.29 | 18 | 26 | 3.57 | 3.57 |
| JUNIPER | 3.45 | 1 | 6.9 | 2 | 27.59 | 8 | 62.07 | 18 | 29 | 3.48 | 3.48 |
| PINE | 5.88 | 2 | 23.53 | 8 | 11.76 | 4 | 58.82 | 20 | 34 | 3.24 | 3.24 |
| OAK | 0 | 0 | 33.33 | 3 | 22.22 | 2 | 44.44 | 4 | 9 | 3.11 | 3.11 |
| LINDEN | 5 | 1 | 25 | 5 | 30 | 6 | 40 | 8 | 20 | 3.05 | 3.05 |
| MAPLE | 17.39 | 4 | 8.7 | 2 | 26.09 | 6 | 47.83 | 11 | 23 | 3.04 | 3.04 |
| ASPEN | 13.64 | 6 | 20.45 | 9 | 20.45 | 9 | 45.45 | 20 | 44 | 2.98 | 2.98 |
| DOGWOOD | 20 | 5 | 12 | 3 | 20 | 5 | 48 | 12 | 25 | 2.96 | 2.96 |
| BIRCH | 18.18 | 4 | 18.18 | 4 | 22.73 | 5 | 40.91 | 9 | 22 | 2.86 | 2.86 |

DISADVANTAGES OF METHOD 2

Similar to the first method but to a lesser degree, the ODS Excel method suffers from the same two problems:

1. This method is also time-consuming because the results are output into separate CROSSTAB tables, which requires the columns to be rearranged so that the corresponding N's and percentage for each rating category are placed in consecutive columns. As with the previous method, the overall ranking is calculated using the formula mentioned earlier and copied for each investigator and sorted in descending order of rank. The Excel table is finalized by adding the title and editing the column labels before sending the report to the agency.

2. The amount of editing required to put the Excel table in its final format with this second method still has the potential to introduce errors into the final table.

In sum, both Methods 1 and 2 used for processing the Ranking Report are time-consuming and have the potential to introduce errors into the final report. When we send reports to the agency, we strive for accuracy. Since the information from the Ranking Report is used as part of the annual evaluations for investigators, we need to be sure that the satisfaction rankings are correct. As a result, we recognized the need to develop SAS programming that produces an Excel table in as close to the "final" format as possible.

METHOD 3: PROC REPORT/ODS EXCEL

To streamline the Excel table editing, we switched to using PROC REPORT within ODS Excel output statements to process the Ranking Report. The REPORT procedure has been available for some time. It was introduced with Version 6 and was a useful tool for customizing report output, but the results were still output into a SAS .LST file (Cochran, 2005). The full production of ODS in Version 8 helped to enhance the look of results, as well as provide the ability to output results into alternative formats (HTML, Word, Excel). By combining both of these tools there is greater flexibility in the final construction of reports, which has taken report writing in SAS to a higher level (Pass, 2003). Method 3 described here is especially useful, as in our case, in producing reports for a government agency that primarily uses Microsoft Office products.

Because the employee supervisors want the Ranking Report in an Excel file, the PROC REPORT procedure lends itself nicely to generating the data, calculating the ranking, and organizing the column structure. This procedure along with ODS allows us to produce the report in nearly its final format in an Excel table. After the report is generated in the Excel table, the table requires only minor editing - the only steps remaining are sorting of the investigators by rank and making minor text edits. Sorting the final results by rank cannot be done from the PROC REPORT statements because rank is determined with this procedure.

PROGRAMMING FOR METHOD 3

```

ODS XML FILE="I:\PEOPLE\MOLLIE\SUGI 2009\PROC REPORT-ODS EXCEL.XLS" TYPE=CSVALL;
PROC REPORT DATA=SURVEY NOWD LS=120 HEADLINE;
TITLE1 'SATISFACTION RANKING FOR INVESTIGATORS - PROC REPORT-ODS EXCEL PROGRAMMING';
WHERE MAILYEAR=2007 AND MAIL=1 AND UNIT IN (1 4 7 9);
COLUMN INVEST N=X RATE, (PCT N) PERCAL N=TOTAL RANKING;
DEFINE INVEST / GROUP 'INVESTIGATOR';
DEFINE RATE / ACROSS ORDER=INTERNAL 'RATING OF SERVICE';
DEFINE X / NOPRINT;
DEFINE PERCAL / NOPRINT;
DEFINE TOTAL / 'TOTAL';
DEFINE N / 'N';
DEFINE PCT / '%' COMPUTED FORMAT=PERCENT8.2;
DEFINE RANKING / 'RANKING' COMPUTED FORMAT=8.2;
FORMAT INVEST INVEST. RATE RATE.;
COMPUTE PERCAL;
  _C3_ = _C4_ / _C2_;
  _C5_ = _C6_ / _C2_;
  _C7_ = _C8_ / _C2_;
  _C9_ = _C10_ / _C2_;
ENDCOMP;
COMPUTE RANKING;
W= _C4_ *1;
X= _C6_ *2;
Y= _C8_ *3;
Z= _C10_ *4;
RANKING=SUM(OF W X Y Z) / _C2_;
ENDCOMP;
RUN;
ODS XML CLOSE;

```

RESULTS FOR METHOD 3

| | A | B | C | D | E | F | G | H | I | J | K | L |
|----|--|-------|---|-------|---|-------|------|-------|----|-----------|---------|---|
| 1 | SATISFACTION RANKING FOR INVESTIGATORS - PROC REPORT-ODS EXCEL PROGRAMMING | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | RATING OF SERVICE | | | | | | | | | | | |
| 4 | POOR | | | FAIR | | | GOOD | | | EXCELLENT | | |
| 5 | INVESTIG. | % | N | % | N | % | N | % | N | TOTAL | RANKING | |
| 6 | ASPEN | 13.64 | 6 | 20.45 | 9 | 20.45 | 9 | 45.45 | 20 | 44 | 2.98 | |
| 7 | BIRCH | 18.18 | 4 | 18.18 | 4 | 22.73 | 5 | 40.91 | 9 | 22 | 2.86 | |
| 8 | DOGWOOD | 20 | 5 | 12 | 3 | 20 | 5 | 48 | 12 | 25 | 2.96 | |
| 9 | ELM | 0 | 0 | 6.06 | 2 | 24.24 | 8 | 69.7 | 23 | 33 | 3.64 | |
| 10 | JUNIPER | 3.45 | 1 | 6.9 | 2 | 27.59 | 8 | 62.07 | 18 | 29 | 3.48 | |
| 11 | LINDEN | 5 | 1 | 25 | 5 | 30 | 6 | 40 | 8 | 20 | 3.05 | |
| 12 | MAPLE | 17.39 | 4 | 8.7 | 2 | 26.09 | 6 | 47.83 | 11 | 23 | 3.04 | |
| 13 | OAK | 0 | 0 | 33.33 | 3 | 22.22 | 2 | 44.44 | 4 | 9 | 3.11 | |
| 14 | PINE | 5.88 | 2 | 23.53 | 8 | 11.76 | 4 | 58.82 | 20 | 34 | 3.24 | |
| 15 | WILLOW | 0 | 0 | 7.14 | 2 | 28.57 | 8 | 64.29 | 18 | 28 | 3.57 | |
| 16 | | | | | | | | | | | | |

FINAL TABLE FOR METHOD 3

| SATISFACTION RANKING FOR INVESTIGATORS - PROC REPORT-ODS EXCEL PROGRAMMING | | | | | | | | | | | |
|--|-------|---|-------|---|-------|---|-----------|----|-------|---------|--|
| RATING OF SERVICE | | | | | | | | | | | |
| INVESTIGATOR | POOR | | FAIR | | GOOD | | EXCELLENT | | TOTAL | RANKING | |
| | % | N | % | N | % | N | % | N | | | |
| ASPEN | 13.64 | 6 | 20.45 | 9 | 20.45 | 9 | 45.45 | 20 | 44 | 2.98 | |
| BIRCH | 18.18 | 4 | 18.18 | 4 | 22.73 | 5 | 40.91 | 9 | 22 | 2.86 | |
| DOGWOOD | 20 | 5 | 12 | 3 | 20 | 5 | 48 | 12 | 25 | 2.96 | |
| ELM | 0 | 0 | 6.06 | 2 | 24.24 | 8 | 69.7 | 23 | 33 | 3.64 | |
| JUNIPER | 3.45 | 1 | 6.9 | 2 | 27.59 | 8 | 62.07 | 18 | 29 | 3.48 | |
| LINDEN | 5 | 1 | 25 | 5 | 30 | 6 | 40 | 8 | 20 | 3.05 | |
| MAPLE | 17.39 | 4 | 8.7 | 2 | 26.09 | 6 | 47.83 | 11 | 23 | 3.04 | |
| OAK | 0 | 0 | 33.33 | 3 | 22.22 | 2 | 44.44 | 4 | 9 | 3.11 | |
| PINE | 5.88 | 2 | 23.53 | 8 | 11.76 | 4 | 58.82 | 20 | 34 | 3.24 | |
| WILLOW | 0 | 0 | 7.14 | 2 | 28.57 | 8 | 64.29 | 18 | 28 | 3.57 | |

ADVANTAGES OF METHOD 3

There are two advantages of using the PROC REPORT procedure and ODS:

1. Producing the Ranking Report using the PROC REPORT and ODS Excel programming allows the report to be done in a very timely fashion. Once the proper PROC REPORT statements are added, the report can be run and sent to the agency within a matter of minutes instead of taking more than an hour to complete.
2. Using Method 3 greatly reduces the possibility of introducing error into the report since the data need not be typed in manually, nor moved; also, we do not have to type in the formula for determining the satisfaction ranking for each investigator. Although we cannot sort the results by investigator ranking from the PROC REPORT statements, this is of minor concern since it is easy to re-sort the data within an Excel table; this poses few problems for introducing error.

CONCLUSION

One of our goals is to provide our agency with accurate information, and this is especially true with the Investigator Satisfaction Ranking Report since it is used in the annual evaluation of case investigators. From the time we began producing this report, it has gone through an evolution of three programming methods as we have become more versed in the programming capabilities of SAS and as part of our continuing efforts to increase the efficiency and accuracy of our reporting.

With the first two iterations of the Ranking Report, two problems existed. First, both methods were quite time-consuming because they required considerable editing to put the report into the final Excel table format. The extensive editing required by both methods leads to the second issue of introducing error into the final report. We need to avoid sources of error because the information we provide to the agency from the Ranking Report impacts an employee's annual evaluation.

Our solution to these problems was to use the PROC REPORT procedure within an ODS output statement to produce the results in nearly final format in an EXCEL table. By using this procedure to generate the results and customize the output within an Excel table, we significantly reduce the amount of editing we need to do, thereby decreasing the potential for introducing error into the results. Also by using this procedure, there is no need to create an Excel database just to run these reports.

As an aside, we do not recommend basing an employee's evaluation strictly on survey results. However, survey results which record customer satisfaction with the service they received provide an important piece of information to be used in conjunction with other benchmarks for performance evaluation.

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CONTACT INFORMATION

Mollie Van Loon
Pennsylvania State University
Room 5, Armsby Building
University Park, PA 16802
mev2@psu.edu

John Shingler
Pennsylvania State University
Room 5, Armsby Building
University Park, PA 16802
jxs10@psu.edu

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