Paper AD04-2011

Using the SAS BI Platform to Support Decision-making at a University

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Abstract

As with many industries, higher education is dealing with increasing challenges. This paper will discuss how KU's Office of Institutional Research and Planning (OIRP) has leveraged SAS products, and in particular, the SAS BI toolset, to deliver critical decision-support information across a spectrum of subject areas during these times of uncertainty and change. The case study discussed will involve student application funnel business process and the scoring of applications using such SAS products as Enterprise Miner, BI Dashboard, and the Add-on to Microsoft Office tools.

Introduction

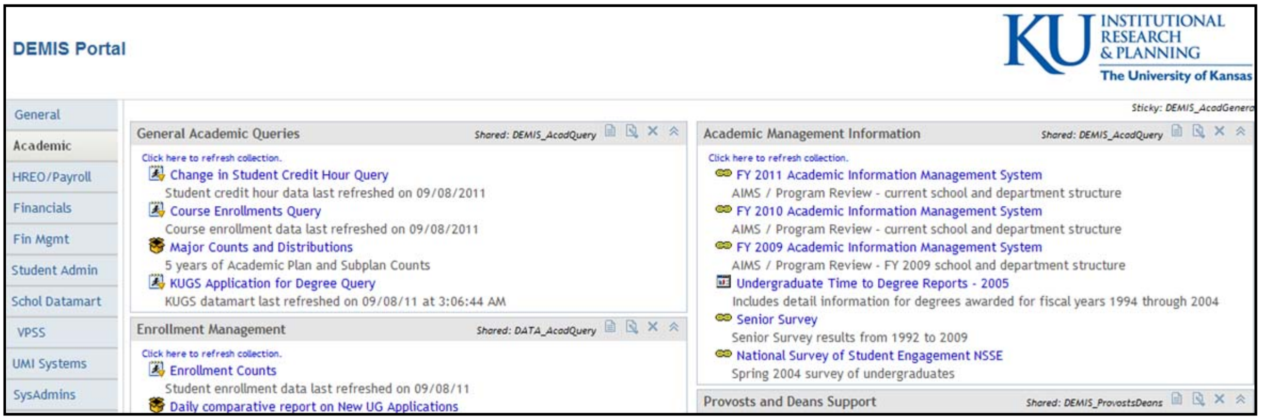
For those not familiar with the administrative structures of higher education institutions, at the University of Kansas the Office of Institutional Research and Planning (OIRP) is a staff office which reports to the Provost/Executive Vice Chancellor. Our mission is dedicated to meeting the data, information, analytical, and planning needs of the Lawrence campus and the central administration of the University of Kansas.

OIRP initially developed a planning and management information system called the Departmental Executive Management Information System (DEMIS). It used SAS® Intrnet products to deliver management and analytical information to departmental administrators since 1999. During the 2007-2008 academic year, OIRP migrated the existing DEMIS system into the new business intelligence (BI) architecture found with the SAS Enterprise BI Server products and switched to the SAS Enterprise BI Server as our production system in July 2008. The original DEMIS system was created using a combination of SAS software and internal development. The migration to the new SAS product was done to move away from an “in-house” development model and use an enterprise-level, integrated BI architecture while leveraging OIRP’s knowledge and experience with SAS. This summer, KU’s DEMIS system was migrated to the SAS 9.2 BI Server version with new hardware. We are finalizing our systems and plan to switch to our 9.2 BI Server system in October 2011.

This paper will describe our decision-support system and specifically discuss the ways in which the University of Kansas has leveraged what SAS and in particular the BI platform provides to help deliver to campus decision-makers the necessary information to effectively manage our institution. As examples, I will use projects dealing with the recruitment of undergraduates throughout this paper.

What is DEMIS?

At KU, DEMIS is the term used for our decision support or business intelligence system. KU is using SAS BI Solution to deliver decision support information via the SAS BI Portal to departmental units. There are five broad areas of information: General, Academic, Financials, HR/Pay, and Student Administration, with a few specialized areas also available, as seen in the tabs along the left side of Figure 1 below.



General Academic Queries — Shared: DEMIS_AcadQuery

Click here to refresh collection.

- Change in Student Credit Hour Query
  Student credit hour data last refreshed on 09/08/2011
- Course Enrollments Query
  Course enrollment data last refreshed on 09/08/2011
- Major Counts and Distributions
  5 years of Academic Plan and Subplan Counts
- KUGS Application for Degree Query
  KUGS datamart last refreshed on 09/08/11 at 3:06:44 AM

Enrollment Management — Shared: DATA_AcadQuery

Click here to refresh collection.

- Enrollment Counts
  Student enrollment data last refreshed on 09/08/11
- Daily comparative report on New UG Applications

Academic Management Information — Shared: DEMIS_AcadQuery

Click here to refresh collection.

- FY 2011 Academic Information Management System
  AIMS / Program Review - current school and department structure
- FY 2010 Academic Information Management System
  AIMS / Program Review - current school and department structure
- FY 2009 Academic Information Management System
  AIMS / Program Review - FY 2009 school and department structure
- Undergraduate Time to Degree Reports - 2005
  Includes detail information for degrees awarded for fiscal years 1994 through 2004
- Senior Survey
  Senior Survey results from 1992 to 2009
- National Survey of Student Engagement NSSE
  Spring 2004 survey of undergraduates

Provosts and Deans Support — Shared: DEMIS_ProvostsDeans

Figure 1: Academic Subject page from KU's DEMIS Portal

These subject areas are organized as pages in the SAS BI Portal, and within each of the pages there will be various portlets or groupings of informational items or reports. The pages, portlets, and items can all have various levels of security roles applied. For instance, at KU in our Academic subject area, we've created a security setup that allows "academic" users to have access to academic items from a general to a highly restricted level of access:

1. DEMIS_AcadGeneral
    a. DEMIS_AcadQuery
        i. DATA_AcadQuery
            1. DEMIS_ProvostDeans

The real strength that the BI Server provides is in providing the decision support manager with a framework to give users the tools to answer their own questions within an appropriate security framework. This can involve anything from static published reports to dynamic queries against live transactional data. We utilize all these methods through a combination of SAS for Windows programs that might publish to the WebDAV that supports the SAS BI system to much more dynamic access of data and information using SAS BI stored process queries, SAS Web Report Studio reports, and SAS BI dashboards that can provide a visual front-end interface to subject area trends and analytics.

Usage of DEMIS

I have just touched on a small subset of the various subject areas and reports that we provide to our user community. The daily usage profile of the queries that run from our system shows that the majority of our queries are around operational business functions. Financial expenditures, from general department needs to those from research grants, are the areas with heaviest customer usage. Figure 2 shows the breakdown by general subject query areas by percentage of use, with an average of about 1,100 stored process queries being run on a daily basis.

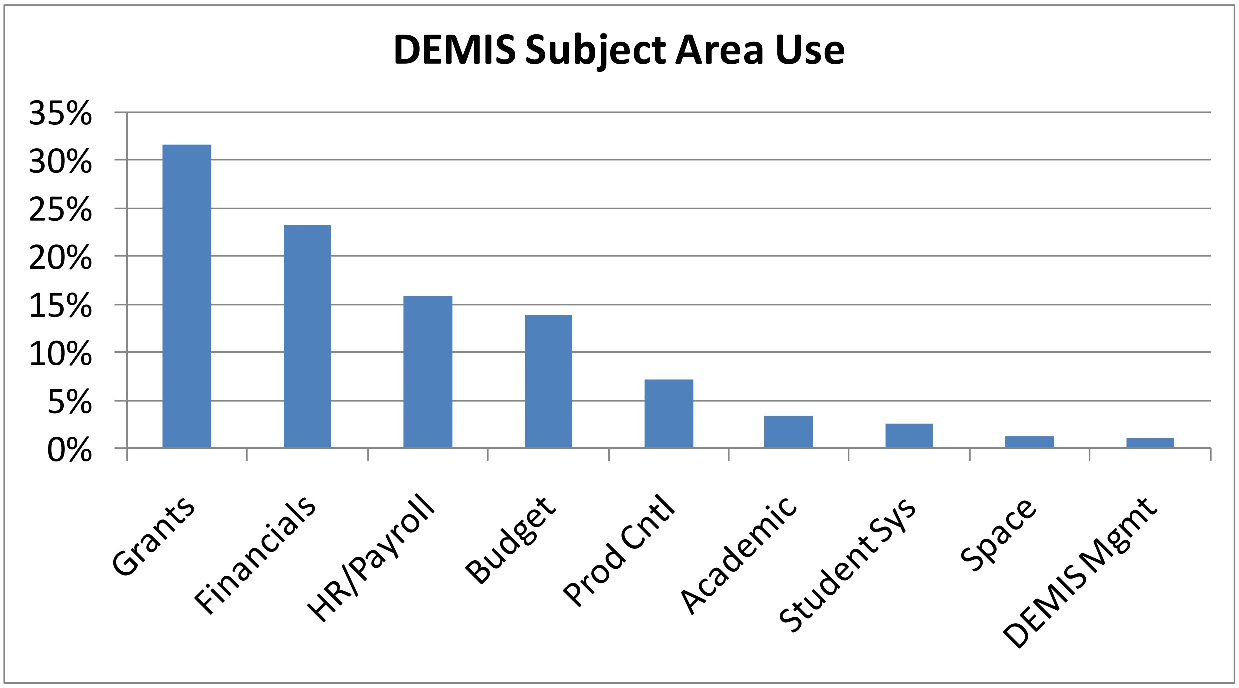


Figure 2: DEMIS subject area usage

DEMIS Hardware Architecture for SAS 9.2 BI Server

For our upgrade to the SAS 9.2 BI Server, we have put three HP ProLiant DL380 G7 Base servers running Red Hat Enterprise Linux 5, with 1 x 2.66 GHz Quad-Core CPU and 30 GB RAM to support mid-tier, metadata, and compute servers. We also have an ETL server with the same specifications to support our use of the SAS Data Integration Studio product and our data warehouse jobs. Figure 3 is a basic architecture diagram of our environment.

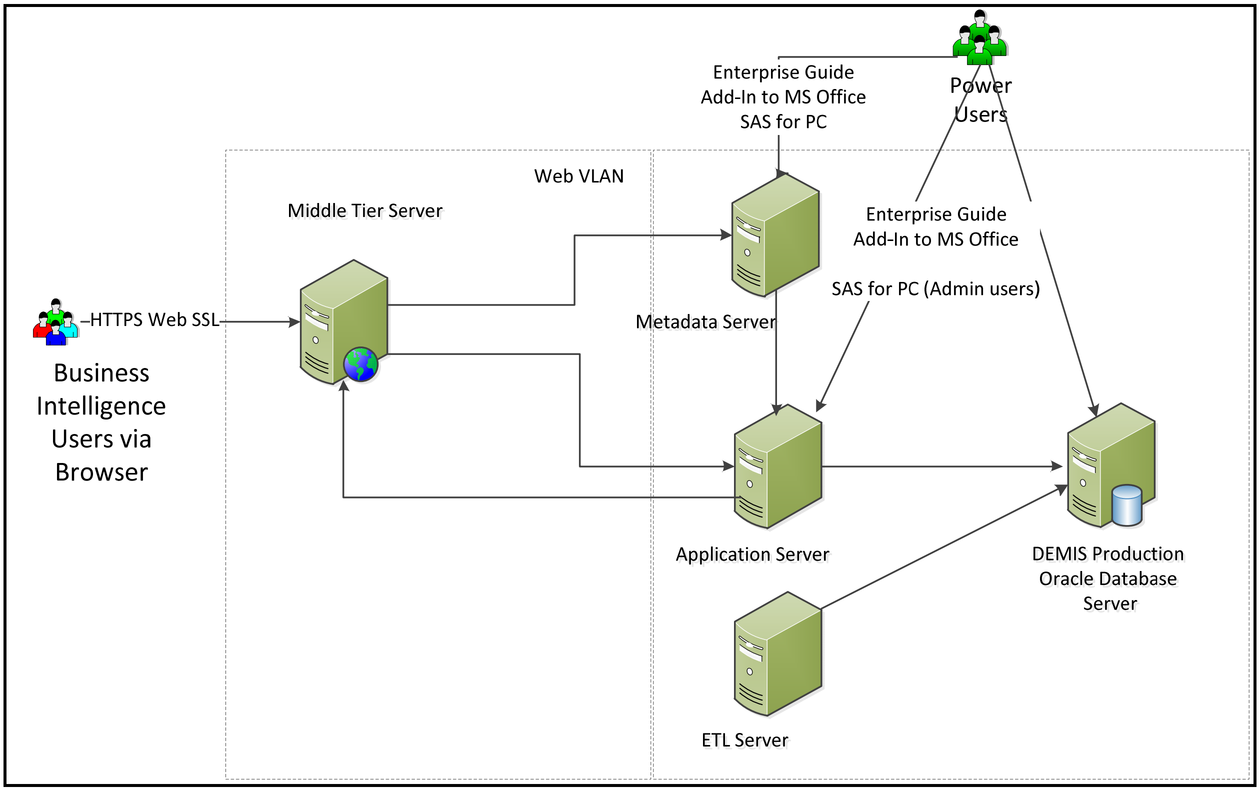


Figure 3: KU's SAS 9.2 BI / ETL Architecture

Other SAS products on campus

The analysts in OIRP as well as in many other administrative offices on campus still use SAS for Windows in much of their day-to-day work. Our administrative suite of products also includes SAS Enterprise Guide, SAS Add-in for Microsoft Office, SAS Data Integration Studio, and OIRP also has a workstation license for SAS Enterprise Miner.

How we use the different elements of our SAS suite of products to support the decision makers on campus, and in particular the recruitment of undergraduate students, will be the primary topic of this paper.

Working to become an Analytical Competitor

In their book *Analytics at Work: Smarter Decisions, Better Results* (2010), Davenport, Harris, & Morison describe their success factors for the capabilities and assets an organization needs to put analytics to work successfully. They use the acronym DELTA, or the Greek letter that signifies “change” in an equation, for keeping these success factors in mind (p. 19):

D	for accessible, high-quality *data*
E	for an *enterprise* orientation
L	for analytical *leadership*
T	for strategic *targets*
A	for *analysts*

The authors propose that these five success factors need to move forward roughly proportional and provide a model of progress for an institution that has five stages (pp. 21-22):

1. *Analytically Impaired*: The organization lacks one or several of the prerequisites for serious analytical work, such as data, analysts, or senior management interests.
2. *Localized Analytics:* There are pockets of analytical activity within the organization, but they are not coordinated or focused on strategic targets.
3. *Analytical Aspirations:* The organization envisions a more analytical future, has established analytical capabilities, and has a few significant initiatives under way, but progress is slow because not all DELTA elements are in place.

4. *Analytical Companies:* The organization has the needed human and technological resources, applies analytics regularly, and realizes benefits across the business. But its strategic focus is not grounded in analytics, and it hasn't turned analytics to competitive advantage.
5. *Analytical Competitors:* The organization routinely uses analytics as a distinctive business capability. It takes an enterprise-wide approach, has committed and involved leadership, and has achieved large-scale results. It portrays itself both internally and externally as an analytical competitor.

During more than twenty years at the University of Kansas in many roles within the area of institutional research, I have seen our institution's administrative areas work through these stages of analytical development as technological and people resources have become available and the campus leadership across many areas seeks out analytics to help support and inform decision making. With many of the pieces in place across our campus, it is my impression that the institution is ready to enter the stage of an Analytical Competitor and the SAS platform, and in particular the SAS BI Server, will be key components that help get us there.

The Case Study: Leveraging our SAS products to understand Undergraduate recruitment

The University of Kansas is a comprehensive research and teaching university that held its first classes in 1866. It has multiple campuses (Main campus: Lawrence; Edwards campus: Overland Park; Medical center: Kansas City, Kan., and Salina; School of Medicine and School of Pharmacy clinical campuses: Wichita) with enrollment around 30,000 students. It offers over 345 degree programs and is a member of the Association of American Universities.

One of the major challenges facing KU is the changing population demographic in Kansas and several area states. The population of high school seniors is decreasing and will continue to do so for several years. The trend graph for the population of Kansas high school seniors in recent and upcoming years is provided below in Figure 4 (Source: Western Interstate Commission for Higher Education, 2008).

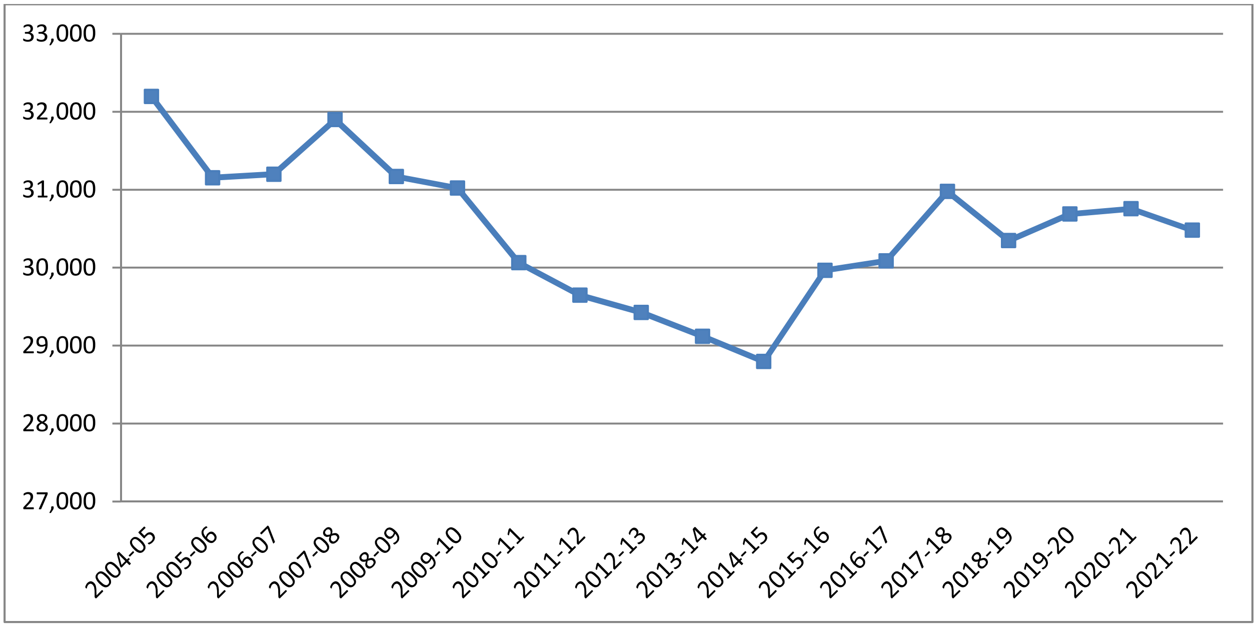


Figure 4: WICHE High School Graduates Projection Data for Kansas

This drop in the number of traditional college attending in-state residents will require the university to find ways to appeal to, and attract high school seniors from other states if we want to maintain a stable level of undergraduate enrollments.

Using SAS GTL: Pictures are worth a thousand words

Starting with SAS 9.2, SAS provided the Graph Template Language which provides the user with the ability to generate professional looking graphic output and store the template for reuse with other data. The GTL is the underlying language for the default templates that are provided by SAS for procedures that use ODS Statistical Graphics and is very powerful.

OIRP was asked to create a report on the enrollment yield of admitted new freshmen by academic ability and various demographics to help understand changing enrollment trends within academic ability groups. Academic ability is a metric that we calculate based on high school GPA and college entrance test scores. The score is binned into five bands, with band #1 being the high academic ability students and band #5 being the lowest. The bin groups are not simple quintiles but based on enrollment and application break points along distribution of the ability metric. Band #1 makes up about three percent of our application volume while Band #5 accounts for almost 50 percent, the rest fall in-between.

The SAS statement to generate the report seen on the page 6 is provided below. But of course the GTL statements are a little more involved. The GTL statements to create the template YLDBNDS are provide in Appendix 1. Additional work can be done to make the template code even more dynamic, but the code below passes to the template the fields in the data set to use for counts of admitted and enrolled students for the left and right side horizontal bar graphs. This style of graph is often referred to as a population tree.

```
ODS LISTING CLOSE;
options orientation=portrait;
ods rtf body=%outpath(_AbilBndYldGrp_&sysdate..rtf) style=lines_oirp_rtf;

%formal(Yield Rates by Ability Bands,
        Fall 2007-Fall 2010,
        Admitted FYR Applications Only);
title2 'By Residency';
proc sgrender data=WORK.bnd_rpt template=YLDBNDS ;
 dynamic _LHDR="Kansas Resident" _RHDR="Out-of-State"
         _L1A="ADM_IS_1" _L1E="ENR_IS_1" _R1A="ADM_OS_1" _R1E="ENR_OS_1"
         _L2A="ADM_IS_2" _L2E="ENR_IS_2" _R2A="ADM_OS_2" _R2E="ENR_OS_2"
         _L3A="ADM_IS_3" _L3E="ENR_IS_3" _R3A="ADM_OS_3" _R3E="ENR_OS_3"
         _L4A="ADM_IS_4" _L4E="ENR_IS_4" _R4A="ADM_OS_4" _R4E="ENR_OS_4"
         _L5A="ADM_IS_5" _L5E="ENR_IS_5" _R5A="ADM_OS_5" _R5E="ENR_OS_5";
run;
```

This report helped illustrate that in recent years we have been seeing a decrease in applicants as well as enrollment yield in the lower ability bands, while the reverse was occurring at the upper bands. This change was occurring during the economic down turn that started in Fall 2008 (but impacted our Fall 2009 class) in combination with the decrease in the high school seniors. In difficult economic times, parents might be less inclined to send their child that might struggle academically to their state's flag-ship university.

So given the environment of fewer Kansas high school seniors and decreasing applications and enrollments in the lower academic ability bands, OIRP is working with the Office of Admissions to identify and score those high school students who "raised their hand" to express interest in KU, and indicate which of them are also likely to apply; as well as once the student is admitted, who is most likely to enroll and be successful.

Using SAS Enterprise Miner: Putting Analytics to Work

SAS Enterprise Miner is the SAS product that is used for data mining. According to the SAS documentation, It "…streamlines the data mining process to create highly accurate predictive and descriptive models based on analysis of vast amounts of data from across an enterprise." (*Getting Started with SAS® Enterprise Miner™ 6.1*). The SAS Enterprise Miner product has a vast array of statistical models that can be applied against data to gain an understanding of patterns and relationships within the data, and is beyond the scope for this paper. Please refer to the documentation for SAS Enterprise Miner on the SAS website for details of the product.

For the purposes of our case study, I will briefly describe what variables we found useful in our inquiry-to-applicant model, and how we make use of the results. In our modeling of inquiry data to applicant, we found the following factors to be important in predicting an application for high school students in Kansas:

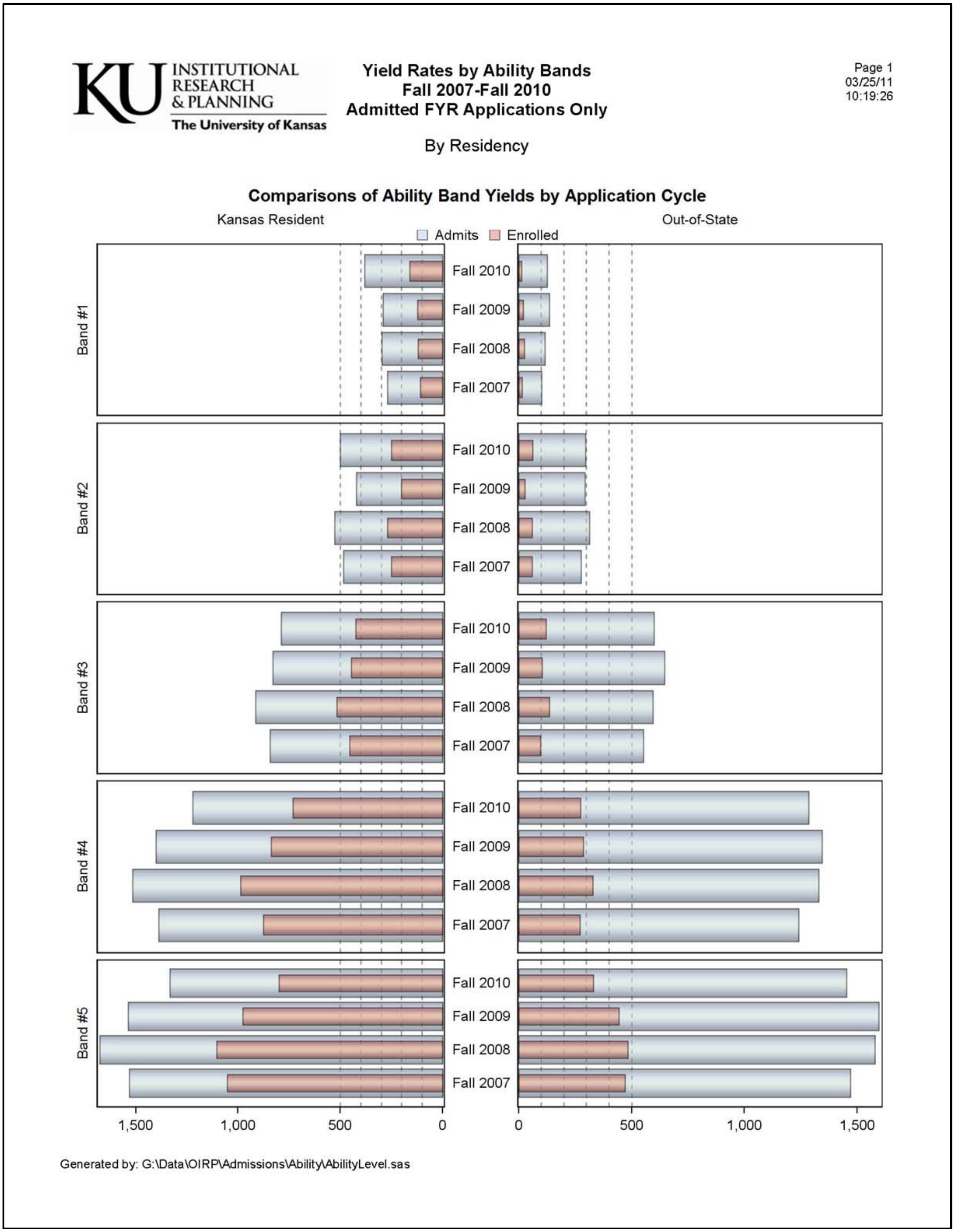
Kansas Resident Model:

Dependent variable:

- Applicant (1/0)

Indicators included in the model:

- Institutional Choice: KU's ranking on college entrance exam
- Distance from KU: Distance between home ZIP code centroid and KU
- Referral Group: How the student came into the prospects data
- Prospect point of creation : HS grade level (9,10,11,12) of student when first entered in prospects data
- Total number of campus visits: Number of times the prospect registered and attended an admissions event



KU INSTITUTIONAL RESEARCH & PLANNING
The University of Kansas

Yield Rates by Ability Bands
Fall 2007-Fall 2010
Admitted FYR Applications Only

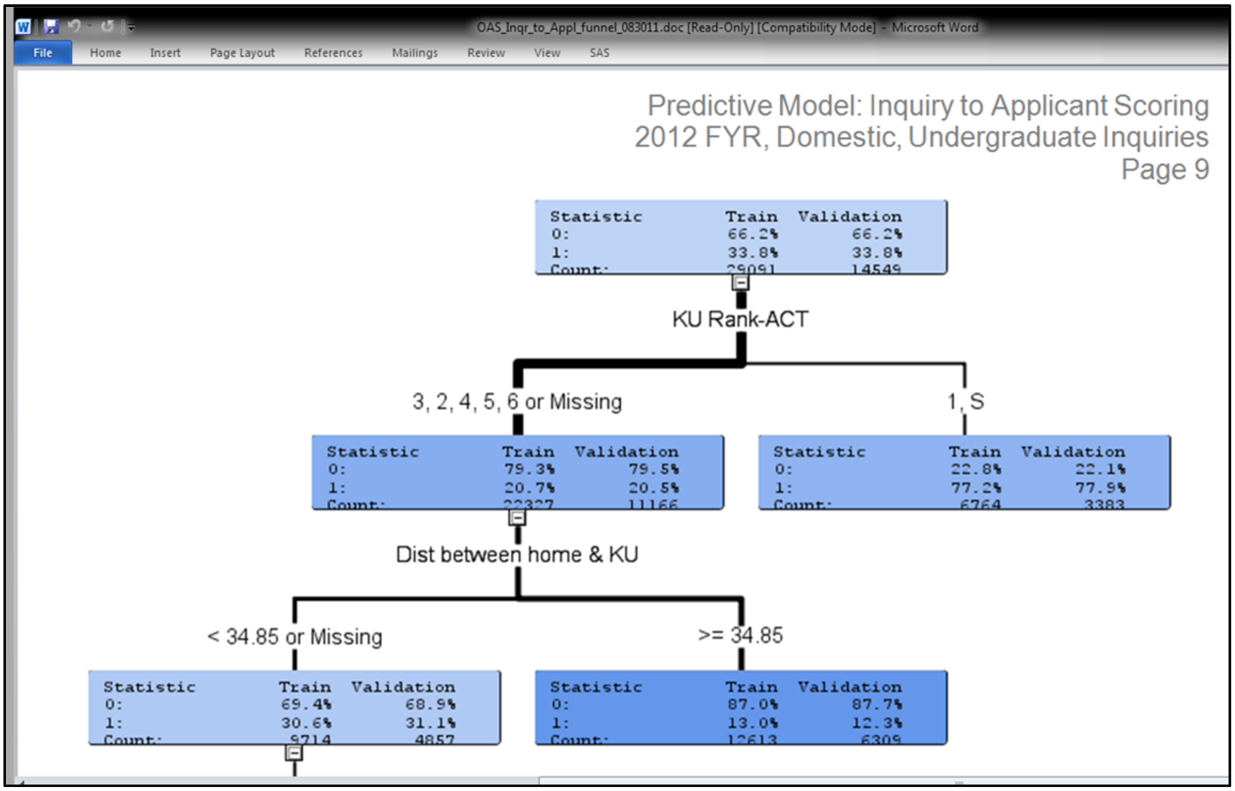
Page 1
03/25/11
10:19:26

By Residency

Generated by: G:\Data\OIRP\Admissions\Ability\AbilityLevel.sas

Figure 5: Example report output using GTL

The SAS Enterprise Miner software found that a decision-tree provided the best predictive models when compared with the validation data set. The mined model (n=43,640), with a 20.5% misclassification rate, predicts 33.8% of inquiries will apply. Institutional choice was the most powerful predictor. Of the students who indicated KU was their 1st choice or who submitted a supplemental score, the model predicted almost 78% will apply. If KU was a student's 2nd to 5th choice or if institutional choice is missing, the model predicted 20.5% will apply. Within this sub-group, students living within 35 miles of KU were more likely to apply than those further away, 31.1% versus 12.3% respectively. A snippet of the decision-tree diagram is found in Figure 6 below:



OAS_Inqr_to_Appl_funnel_083011.doc [Read-Only] [Compatibility Mode] - Microsoft Word
File
Home
Insert
Page Layout
References
Mailings
Review
View
SAS

Predictive Model: Inquiry to Applicant Scoring
2012 FYR, Domestic, Undergraduate Inquiries
Page 9

Statistic	Train	Validation
0:	66.2%	66.2%
1:	33.8%	33.8%
Count:	29091	14549

Statistic	Train	Validation
0:	79.3%	79.5%
1:	20.7%	20.5%
Count:	22327	11166

Statistic	Train	Validation
0:	22.8%	22.1%
1:	77.2%	77.9%
Count:	6764	3383

Statistic	Train	Validation
0:	69.4%	68.9%
1:	30.6%	31.1%
Count:	9714	4857

Statistic	Train	Validation
0:	87.0%	87.7%
1:	13.0%	12.3%
Count:	12613	6309

Figure 6: Decision-tree diagram of Kansas Inquiry-to-Applicant model

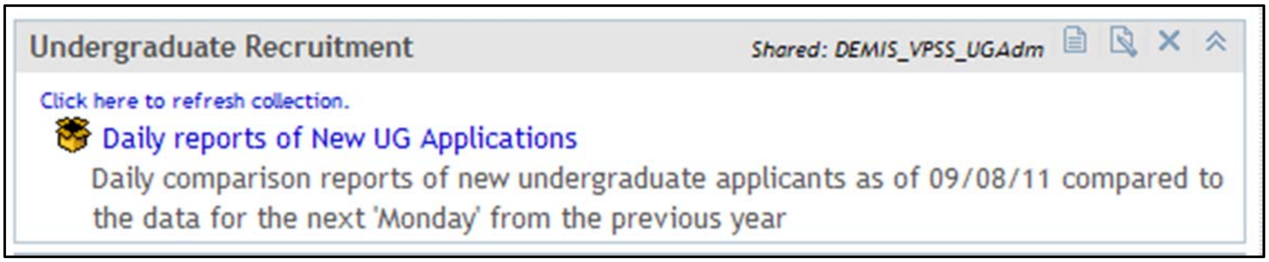
SAS Enterprise Miner provides the scoring code from the model to use with your databases. We can take the scoring code generated by the model and apply it to our constantly changing inquiry pool to score and categorize the prospective applicants. This information provides our campus undergraduate recruiters additional insights on where to spend their time and resources. A sample of what the scoring code generated by SAS Enterprise Miner looks like is provided below. Notice that the variable **`P_APPLICANT1,`** or the probability of becoming an applicant highlighted by the box below, is set to 0.7717 (or the 77.2% seen in the right-most node in the second row of boxes in Figure 6), and the `I_APPLICANT` field gets set to '1' or that we are "flagging" and predicting that an inquiry with institutional choice values of 1 or S will be applying to KU.

```
******              ASSIGN OBSERVATION TO NODE             ******;
_ARBFMT_1 = PUT( INST_CHOICE , $1.);
 %DMNORMIP( _ARBFMT_1);
IF _ARBFMT_1 IN ('1' ,'S' ) THEN DO;
  _NODE_  =                    2;
  _LEAF_  =                    1;
  P_APPLICANT0  =     0.22826729745712;
  P_APPLICANT1  =     0.77173270254287;
  V_APPLICANT0  =     0.22110552763819;
  V_APPLICANT1  =      0.7788944723618;
  I_APPLICANT  = '1' ;
  U_APPLICANT  =                    1;
  END;
ELSE DO;
<additional node scoring has been removed; about 100 lines of scoring code>
```

Making the Results of the scoring available to the Enterprise

The Office of Admissions has requested that they would like those inquires who have not applied to be scored and categorized on a scale of 1 to 10 once a week. With 10 representing the highest likelihood to apply and 1 the lowest. The scoring will be done through a nightly SAS batch job that provides a data feed back into KU's undergraduate prospect data system as well as being surfaced on DEMIS for reporting and analytics.

Making the operational data available to undergraduate recruiters is currently done by creating contact listings of inquiries and publishing the spreadsheet XML to the SAS BI Server WebDAV. We plan to publish to individual recruiter WebDAV folders just their contacts to pursue using the SAS publishing framework. This will be done when we complete our upgrade to the SAS 9.2 BI Server environment. What this looks like currently on the DEMIS portal for next fall's applicants is displayed below in Figures 7, 8, and 9.



Undergraduate Recruitment

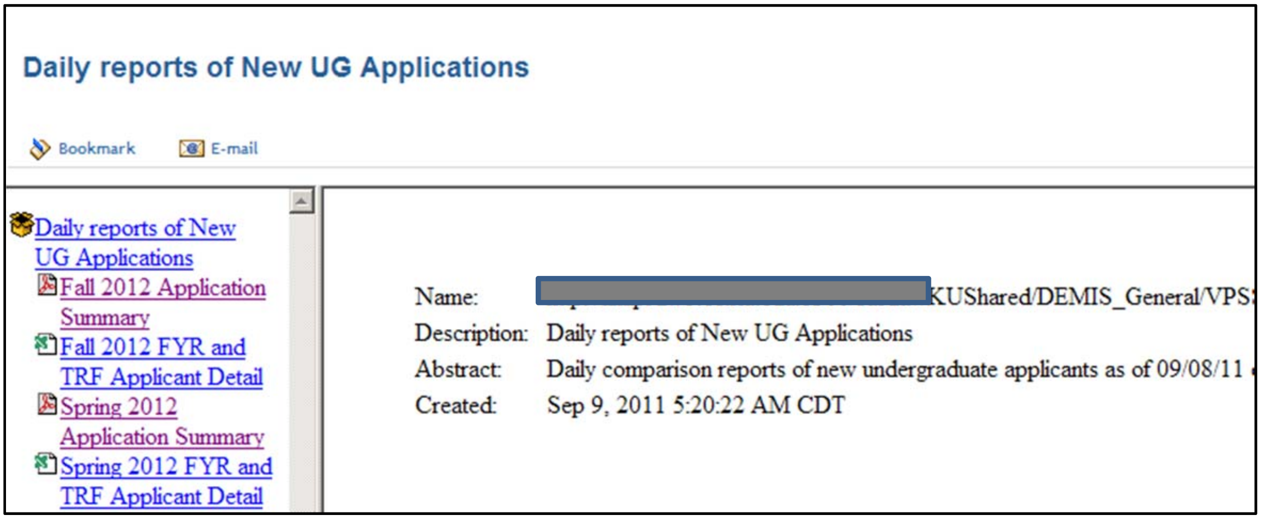
Shared: DEMIS_VPSS_UGAdm

Click here to refresh collection.

Daily reports of New UG Applications

Daily comparison reports of new undergraduate applicants as of 09/08/11 compared to the data for the next 'Monday' from the previous year

Figure 7: Published Package surfaced in a SAS BI portlet



Daily reports of New UG Applications

Daily reports of New UG Applications
- Fall 2012 Application Summary
- Fall 2012 FYR and TRF Applicant Detail
- Spring 2012 Application Summary
- Spring 2012 FYR and TRF Applicant Detail

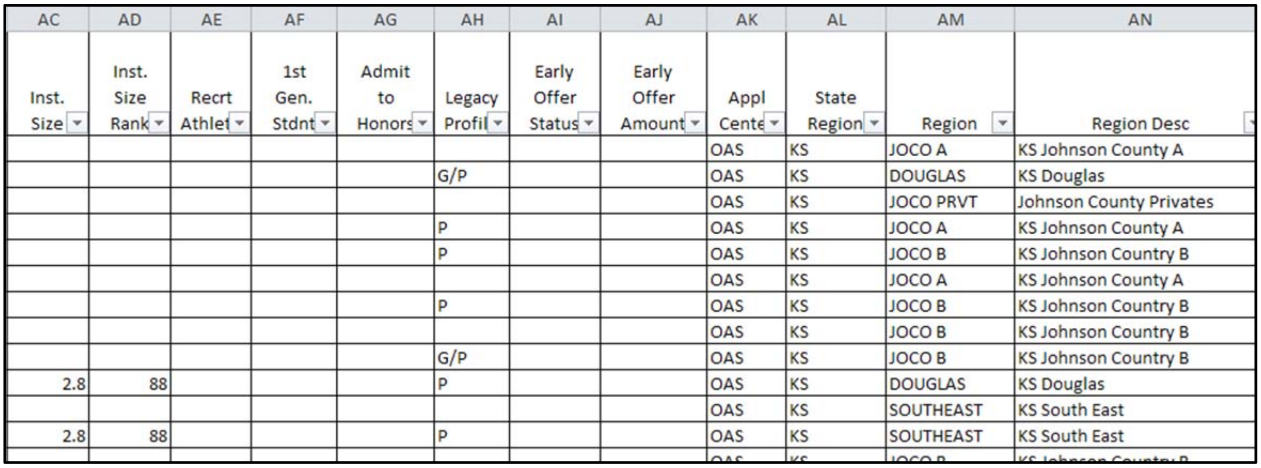
Name: [redacted]KUShared/DEMIS_General/VPS

Description: Daily reports of New UG Applications

Abstract: Daily comparison reports of new undergraduate applicants as of 09/08/11

Created: Sep 9, 2011 5:20:22 AM CDT

Figure 8: Package of Reports made available each day on Portal



AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
Inst. Size	Inst. Size Rank	Recrt Athlet	1st Gen. Stdnt	Admit to Honors	Legacy Profil	Early Offer Status	Early Offer Amount	Appl Cente	State Region	Region	Region Desc
								OAS	KS	JOCO A	KS Johnson County A
					G/P			OAS	KS	DOUGLAS	KS Douglas
								OAS	KS	JOCO PRVT	Johnson County Privates
					P			OAS	KS	JOCO A	KS Johnson County A
					P			OAS	KS	JOCO B	KS Johnson Country B
								OAS	KS	JOCO A	KS Johnson County A
					P			OAS	KS	JOCO B	KS Johnson Country B
								OAS	KS	JOCO B	KS Johnson Country B
					G/P			OAS	KS	JOCO B	KS Johnson Country B
2.8	88				P			OAS	KS	DOUGLAS	KS Douglas
								OAS	KS	SOUTHEAST	KS South East
2.8	88				P			OAS	KS	SOUTHEAST	KS South East
								OAS	KS	JOCO B	KS Johnson Country B

Figure 9: A few of the data items available to recruiters on a daily basis

We create our spreadsheets using the SAS ODS MARKUP TAGSET=ExcelXP. We find that this spreadsheet XML ODS output format allows us programmatically apply formatting options. Some of the options that we use for this particular report are listed below, but of particular use is setting all the columns with an auto filter and freezing the header row so that as a user scrolls down the header stays in frame:

```
ods markup tagset=excelxp style=minimal  body=XLSFILE
   options( AutoFilter='YES' Frozen_Headers='Yes'
            Row_Repeat='1' Orientation='Landscape'
            Center_Horizontal='yes' AUTOFIT_HEIGHT ='YES' PRINT_HEADER_MARGIN='0.3'
            PRINT_FOOTER_MARGIN='0.3' SHEET_INTERVAL='PROC' SHEET_NAME="Freshmen" );
```

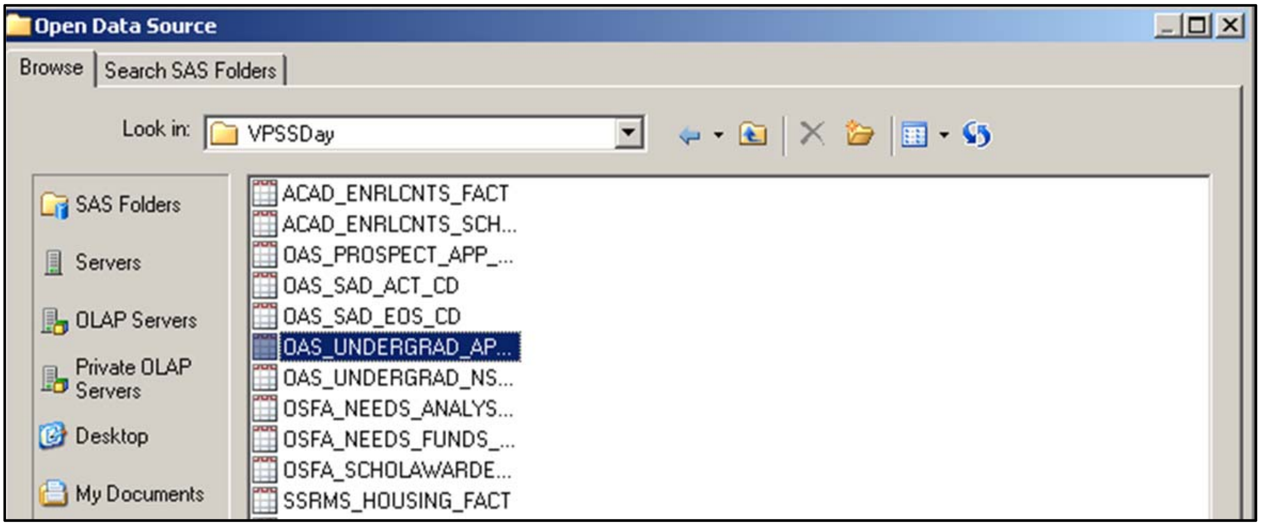
Publishing content to the SAS BI WebDAV can be accomplished in many ways, but we will often use the publishing framework feature of SAS Integration Technologies that consists of SAS CALL routines that can be coded in a DATA step. A snippet of the SAS code used to publish the reports on the previous page is listed below. The statements within angle brackets (“< >”) are just place holders for this paper and not part of the actual code.

```
       desc="Fall &appyr FYR and TRF Applicant Detail";
          CALL INSERT_FILE(packageId,
             "filename:&wdir/Fall_ADM_Applicant_detail.xml","BINARY",
             "application/vnd.ms-excel", desc, nameValue, rc);
          if rc ne 0 then do;
               msg=sysmsg();
               put 'Insert File issue: ' msg;
               abort;
          end;
       call package_publish(packageId, 'TO_WEBDAV', rc,
            'HTTP_USER,HTTP_PASSWORD,COLLECTION_URL,IF_EXISTS',
            '<system account>','{sasenc}<system password>',
            '<our URL root>/KUShared/DEMIS_General/VPSS/Recruitment/DailyRpts',
            "UPDATE");
          if rc ne 0 then do;
               msg=sysmsg();
               put 'Package Publish issue: ' msg;
               abort;
          end;
```

Publishing in this way allows the recruiters to always have access to their contacts of interest if they have access to the internet. If they are on campus and in their office, we plan to allow them to access the data tables directly from their desktops using SAS Add-in to Microsoft Office once we finish the migration to the SAS 9.2 BI environment.

Opening a Data table in Excel using the SAS Add-in to Microsoft Office

The nice thing about the SAS BI platform is that we can leverage the security framework in the metadata server to allow our users to access data they need to get to in a secure manner. If a user has access to the SAS library where we have registered an Oracle reporting datamart, the user can browse to the table as illustrated in Figure 10 below:

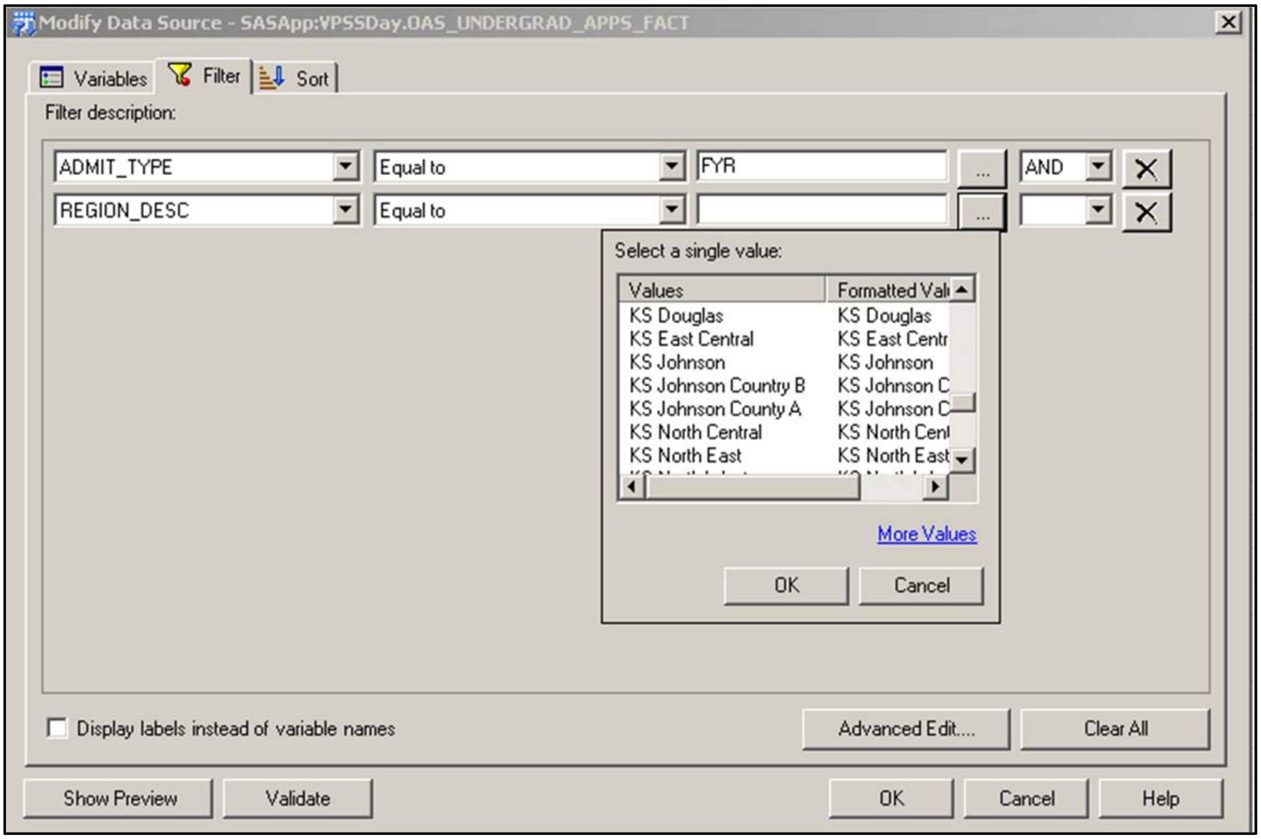


Look in: VPSSDay

ACAD_ENRLCNTS_FACT
ACAD_ENRLCNTS_SCH...
OAS_PROSPECT_APP_...
OAS_SAD_ACT_CD
OAS_SAD_EOS_CD
OAS_UNDERGRAD_AP...
OAS_UNDERGRAD_NS...
OSFA_NEEDS_ANALYS...
OSFA_NEEDS_FUNDS_...
OSFA_SCHOLAWARDE...
SSRMS_HOUSING_FACT

Figure 10: Opening a SAS BI data source in Excel

The user can apply filters to select just those records that they are interested in, which in Figure 11 below, is new freshmen (FYR admit type) and then pick a recruitment region of interest.



Modify Data Source - SASApp:VPSSDay.OAS_UNDERGRAD_APPS_FACT

Filter description:

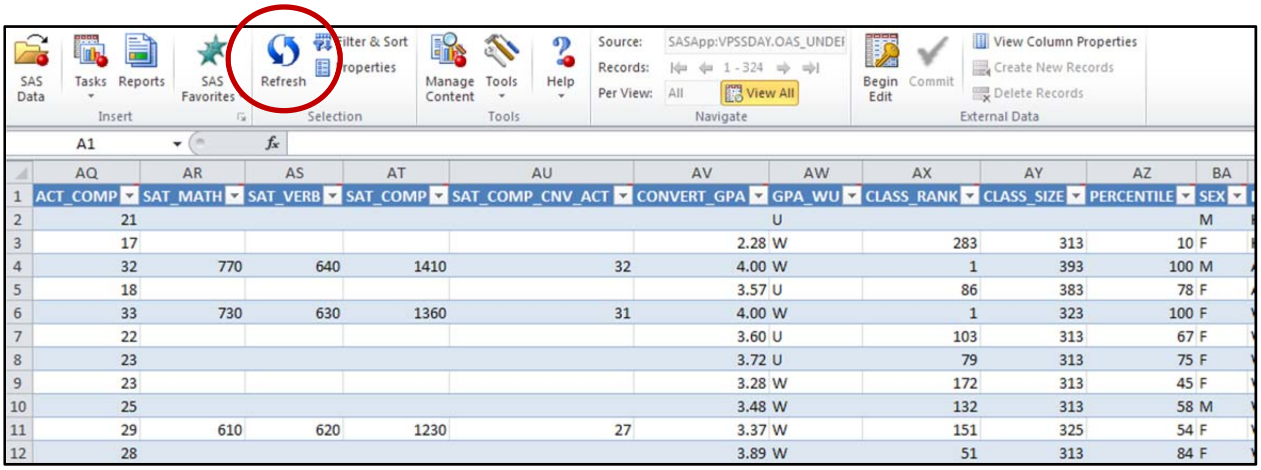
ADMIT_TYPE	Equal to	FYR	AND
REGION_DESC	Equal to		

Select a single value:

Values	Formatted Val
KS Douglas	KS Douglas
KS East Central	KS East Centr
KS Johnson	KS Johnson
KS Johnson Country B	KS Johnson C
KS Johnson County A	KS Johnson C
KS North Central	KS North Cent
KS North East	KS North East

Figure 11: Filtering a BI data source in Excel

An opened data table with the SAS Add-in to Microsoft Office toolbar displayed is illustrated below in Figure 12. The user can save the spreadsheet, open it one week later, hit the “Refresh” icon (circled in red below), and get their spreadsheet refreshed with up-to-date data from the warehouse.



Source: SASApp:VPSSDAY.OAS_UNDEI

Records: 1 - 324

Per View: All View All

A1

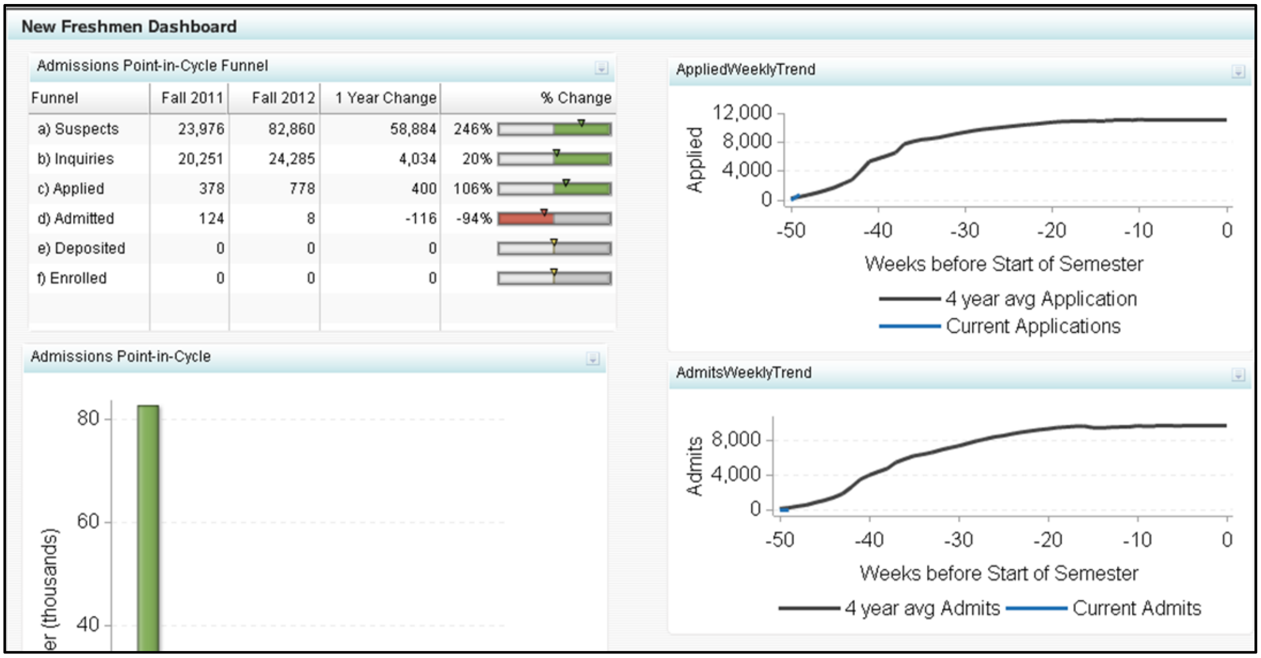
	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA
1	ACT_COMP	SAT_MATH	SAT_VERB	SAT_COMP	SAT_COMP_CNV_ACT	CONVERT_GPA	GPA_WU	CLASS_RANK	CLASS_SIZE	PERCENTILE	SEX
2	21						U				M
3	17					2.28	W	283	313	10	F
4	32	770	640	1410	32	4.00	W	1	393	100	M
5	18					3.57	U	86	383	78	F
6	33	730	630	1360	31	4.00	W	1	323	100	F
7	22					3.60	U	103	313	67	F
8	23					3.72	U	79	313	75	F
9	23					3.28	W	172	313	45	F
10	25					3.48	W	132	313	58	M
11	29	610	620	1230	27	3.37	W	151	325	54	F
12	28					3.89	W	51	313	84	F

Figure 12: A SAS BI data source opened in Excel

Using SAS BI Dashboard to get an idea of the changing picture

This is the one area that we am looking forward to exploring the most with our new SAS BI Server environment. The updated SAS BI Dashboard product has many new features that we cannot wait to exploit. We have just begun to get into this product in our test environment, but I believe that it will provide our senior administrators with quick and easy to understand information for many of our key strategic initiatives.

A quick proto-type of a dashboard for next year's new freshmen prospects and applications can be seen below in Figure 13.



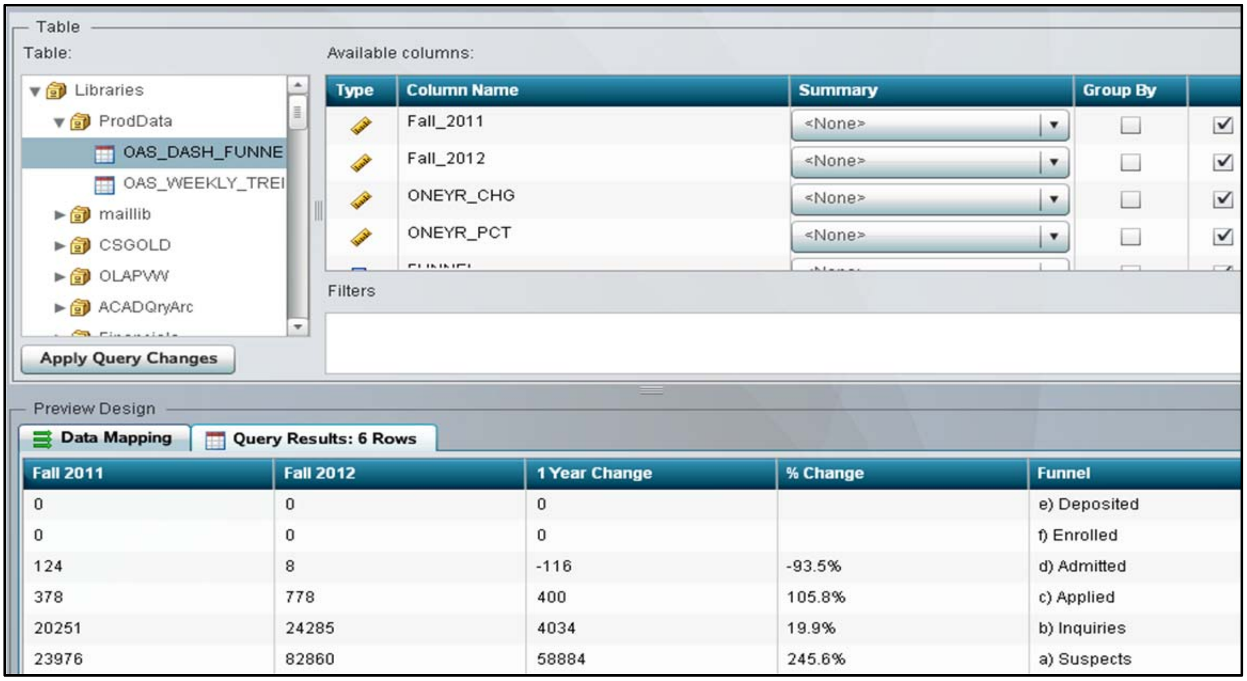
New Freshmen Dashboard

Admissions Point-in-Cycle Funnel

Funnel	Fall 2011	Fall 2012	1 Year Change	% Change
a) Suspects	23,976	82,860	58,884	246%
b) Inquiries	20,251	24,285	4,034	20%
c) Applied	378	778	400	106%
d) Admitted	124	8	-116	-94%
e) Deposited	0	0	0	
f) Enrolled	0	0	0	

Figure 13: Prototype of a New Freshmen Application Dashboard

The interface to work with the SAS BI Dashboard allows a developer to edit and manage data sources, range levels, indicators, and a dashboard that brings all those elements together. For instance to adjust or change how a defined data source works, the developer is provided with the interface displayed in Figure 14.



Table

Table:

- Libraries
  - ProdData
    - OAS_DASH_FUNNE
    - OAS_WEEKLY_TREI
  - maillib
  - CSGOLD
  - OLAPVW
  - ACADQryArc

Available columns:

Type	Column Name	Summary	Group By	
	Fall_2011	<None>	□	☑
	Fall_2012	<None>	□	☑
	ONEYR_CHG	<None>	□	☑
	ONEYR_PCT	<None>	□	☑

Fall 2011	Fall 2012	1 Year Change	% Change	Funnel
0	0	0		e) Deposited
0	0	0		f) Enrolled
124	8	-116	-93.5%	d) Admitted
378	778	400	105.8%	c) Applied
20251	24285	4034	19.9%	b) Inquiries
23976	82860	58884	245.6%	a) Suspects

Figure 14: Interface to work with BI Dashboard Indicator Data

The indicators can also be linked to other SAS reports so that the user can click through to more detailed data if that is desired by the developer. If things get tricky and the developer desires to apply code and logic behind the dashboard displays, SAS BI Dashboard can launch SAS stored processes (program code) behind the scenes to revise and adjust the data that feeds the indictators. SAS stored processes can also be used to generate graphic images that will be treated as static image content by the dashboard even though the image is being created upon the launch or refresh of the given indicator. There are many interesting examples of how to do these things in the proceedings of the 2011 SAS Global Forum (see articles by Craige, and Renison).

Conclusion

At the University of Kansas, we have found that our suite of SAS products, and in particular the SAS BI Server platform, provide us with a convenient and integrated delivery system for our decision-support and analytical needs. Not only can we provide the standard reports for campus business processes, but we can also make use of the platform to provide and deliver information from multiple SAS products as the need requires it.

We will soon be finalizing our upgrade to the SAS 9.2 BI platform and are eager to take advantage of the improvements and additional features that come with that system, in particular the enhancements to SAS Add-In to Microsoft Office and the SAS BI Dashboard.

References

Craige, Rob. (2011). “Enrich Your SAS Reporting with SAS® Predictive Analytics.” *Proceedings of the SAS Global Forum 2011 Conference*. Cary, NC: SAS Institute Inc.

Davenport, T.H., Harris, J.G., & Morison, R. (2010). *Analytics at Work: Smarter Decisions, Better Results.* Boston, MA: Harvard Business Press.

Renison, Keith. (2011). “Match Made in Heaven: Predictive Analytics and the SAS® BI Dashboard 4.3.” *Proceedings of the SAS Global Forum 2011 Conference*. Cary, NC: SAS Institute Inc.

Western Interstate Commission for Higher Education. (2008), *Knocking at the College Door: Projections of High School Graduates by State and Race/Ethnicity 1992-2022*. Boulder, CO: Author.

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I would like to acknowledge Trina Ramirez, Ph.D., an OIRP research analyst, and her work with the data mining project and her report on the inquiry-to-applicant scoring model.

Recommended Reading

SAS Institute Inc. (2009). *Getting Started with SAS® Enterprise MinerTM 6.1*. Cary, NC: Author.

SAS Institute Inc. (2009). *SAS/GRAPH® 9.2: Graph Template Language User's Guide, Second Edition*. Cary, NC: Author.

Contact Information

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Web: http://www.oirp.ku.edu

Appendix 1

GTL statements used to render graph on page 6.

```
proc template;
define statgraph YLDBNDS;
begingraph / designheight=8.75in designwidth=7.5in border=false;
dynamic _LHDR _RHDR _L1A _L1E _R1A _R1E  _L2A _L2E _R2A _R2E _L3A _L3E _R3A _R3E
        _L4A _L4E _R4A _R4E  _L5A _L5E _R5A _R5E;
entrytitle _id='title' halign=center 'Comparisons of Ability Band Yields by Application Cycle' /
textattrs=(FAMILY="Arial");
layout lattice _id='lattice' / columndatarange=UNION COLUMNWEIGHTS=(.45 .55)
                               columngutter=5 columns=2
                               rowdatarange=data rowgutter=2 rows=5;
 rowheaders;
    entry "Band #1" / ROTATE=90 textattrs=(FAMILY="Arial");
    entry "Band #2" / ROTATE=90 textattrs=(FAMILY="Arial");
    entry "Band #3" / ROTATE=90 textattrs=(FAMILY="Arial");
    entry "Band #4" / ROTATE=90 textattrs=(FAMILY="Arial");
    entry "Band #5" / ROTATE=90 textattrs=(FAMILY="Arial");
 endrowheaders;
 SIDEBAR  / ALIGN= TOP ;
  discretelegend 'ADMIS1' 'ENRIS1' / across=2 BORDER=FALSE VALUEATTRS=(FAMILY="Arial");
 endsidebar;
  COLUMN2HEADERS;
    entry _LHDR  / textattrs=(FAMILY="Arial");
    entry _RHDR  / textattrs=(FAMILY="Arial");
  ENDCOLUMN2HEADERS;
         layout overlay _id='L1' / xaxisopts=(reverse=true DISPLAY=( LINE ))
                   yaxisopts=(display=(LINE ));
                   REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
            barchart _id='L1A' x=APPL_CYCLE y=_L1A  / name='ADMIS1' skin=modern
                                LEGENDLABEL= "Admits" datatransparency=0.5 orient=horizontal;
            barchart _id='L1E' x=APPL_CYCLE y=_L1E  / name='ENRIS1' skin=modern
                                LEGENDLABEL= "Enrolled" barwidth=0.51 datatransparency=0.5
                                fillattrs=GraphData2 orient=horizontal;
         endlayout;
         layout overlay _id='R1' / xaxisopts=(DISPLAY=( LINE )) yaxisopts=(display=(TICKVALUES
                                    LINE ) TICKVALUEATTRS=(FAMILY="Arial"));
                   REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
            barchart _id='R1A' x=APPL_CYCLE y=_R1A / name='ADMOS1' skin=modern
                     datatransparency=0.5 orient=horizontal;
            barchart _id='R1E' x=APPL_CYCLE y=_R1E / name='ENROS1' skin=modern barwidth=0.51
                     datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
         endlayout;
         layout overlay _id='L2' / xaxisopts=(reverse=true DISPLAY=( LINE ))
                   yaxisopts=(display=(LINE ));
                   REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
            barchart _id='L2A' x=APPL_CYCLE y=_L2A / name='ADMIS2' skin=modern
                     datatransparency=0.5 orient=horizontal;
            barchart _id='L2E' x=APPL_CYCLE y=_L2E / name='ENRIS2' skin=modern barwidth=0.51
                     datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
         endlayout;
         layout overlay _id='R2' / xaxisopts=(DISPLAY=( LINE  )) yaxisopts=(display=(
                   TICKVALUES LINE ) TICKVALUEATTRS=(FAMILY="Arial"));
                   REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
                   REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
            barchart _id='R2A' x=APPL_CYCLE y=_R2A / name='ADMOS2' skin=modern
                     datatransparency=0.5 orient=horizontal;
```

```
   barchart _id='R2E' x=APPL_CYCLE y=_R2E / name='ENROS2' skin=modern barwidth=0.51
            datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
endlayout;
layout overlay _id='L3' / xaxisopts=(reverse=true DISPLAY=( LINE ))
          yaxisopts=(display=(LINE ));
          REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
   barchart _id='L3A' x=APPL_CYCLE y=_L3A / name='ADMIS3' skin=modern
            datatransparency=0.5 orient=horizontal;
   barchart _id='L3E' x=APPL_CYCLE y=_L3E / name='ENRIS3' skin=modern barwidth=0.51
            datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
endlayout;
layout overlay _id='R3' / xaxisopts=(DISPLAY=( LINE )) yaxisopts=(display=( TICKVALUES
          LINE ) TICKVALUEATTRS=(FAMILY="Arial"));
          REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
   barchart _id='R3A' x=APPL_CYCLE y=_R3A / name='ADMOS3' skin=modern
            datatransparency=0.5 orient=horizontal;
   barchart _id='R3E' x=APPL_CYCLE y=_R3E / name='ENROS3' skin=modern barwidth=0.51
            datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
endlayout;
layout overlay _id='L4' / xaxisopts=(reverse=true DISPLAY=( LINE ))
          yaxisopts=(display=(LINE ));
          REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
   barchart _id='L4A' x=APPL_CYCLE y=_L4A / name='ADMIS4' skin=modern
            datatransparency=0.5 orient=horizontal;
   barchart _id='L4E' x=APPL_CYCLE y=_L4E / name='ENRIS4' skin=modern barwidth=0.51
            datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
endlayout;
layout overlay _id='R4' / xaxisopts=(DISPLAY=( LINE )) yaxisopts=(display=( TICKVALUES
          LINE ) TICKVALUEATTRS=(FAMILY="Arial"));
          REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
   barchart _id='R4A' x=APPL_CYCLE y=_R4A / name='ADMOS4' skin=modern
            datatransparency=0.5 orient=horizontal;
   barchart _id='R4E' x=APPL_CYCLE y=_R4E / name='ENROS4' skin=modern barwidth=0.51
            datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
endlayout;
layout overlay _id='L5' / xaxisopts=(reverse=true DISPLAY=( LINE TICKS TICKVALUES )
          TICKVALUEATTRS=(FAMILY="Arial")) yaxisopts=(display=(LINE ));
          REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
   barchart _id='L5A' x=APPL_CYCLE y=_L5A / name='ADMIS5' skin=modern
            datatransparency=0.5 orient=horizontal;
   barchart _id='L5E' x=APPL_CYCLE y=_L5E / name='ENRIS5' skin=modern barwidth=0.51
            datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
endlayout;
layout overlay _id='R5' / xaxisopts=(DISPLAY=( LINE TICKS TICKVALUES )
          TICKVALUEATTRS=(FAMILY="Arial"))
                          yaxisopts=(display=( TICKVALUES LINE )
          TICKVALUEATTRS=(FAMILY="Arial"));
          REFERENCELINE X = 100 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 200 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 300 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 400 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
          REFERENCELINE X = 500 / LINEATTRS=(COLOR=GRAY PATTERN=SHORTDASH);
   barchart _id='R5A' x=APPL_CYCLE y=_R5A / name='ADMOS5' skin=modern
            datatransparency=0.5 orient=horizontal;
   barchart _id='R5E' x=APPL_CYCLE y=_R5E / name='ENROS5' skin=modern barwidth=0.51
```

```
                     datatransparency=0.5 fillattrs=GraphData2 orient=horizontal;
         endlayout;
endlayout;
endgraph;
end;
run;

/* Additional code for the SAS macro calls in the GTL example */

%macro FORMAL(ttl1,ttl2,ttl3,pno);
/***********************************************************
************************************************************
**      Office of Institutional Research & Planning       **
**                      SAS Macro                         **
**  ----------------------------------------------------  **
** Description:                                           **
**  OIRP Formal report title macro for RTF ODS report     **
**  output.                                               **
**  ----------------------------------------------------  **
** Created: 03/28/07                      By: R. Cherland **
************************************************************
***********************************************************/
*;
%let sep=\;
%let execpath=;
%let execpath=%sysfunc(GetOption(SYSIN));
%if %length(&execpath)=0 and %symexist(_CLIENTPROJECTPATH)=0 %then
       %let execpath=%sysget(SAS_EXECFILEPATH);
%else %if %symexist(_CLIENTPROJECTPATH) %then
       %let execpath=%substr(&_CLIENTPROJECTPATH,2,%eval(%length(&_CLIENTPROJECTPATH)-2));
%else
       %let execpath=G:\DATA\OIRP\PleaseNameMe.sas);
%*;
%let prog=%scan(&execpath,-1,&sep);
%let path=%substr(&execpath,1,%eval(%length(&execpath)-%length(&prog)));
%*;
%let right1=Page (*ESC*){thispage};
%let right2=%sysfunc(date(),mmddyy8.);
%let right3=%sysfunc(time(),time8.);
%*;
%if &pno gt 0 %then %do;
options pageno=&pno;
%end;
title1 j=l '(*ESC*)S={preimage="C:\SAS\macros\formal.jpg"}'
       j=c h=11pt "(*ESC*)S={font_weight=bold}&ttl1(*ESC*)n&ttl2(*ESC*)n&ttl3(*ESC*)S={}"
       j=r h=8pt "&right1(*ESC*)n&right2(*ESC*)n&right3";
footnote1 j=l h=8pt "Generated by: &path.&prog";
%*;
options nodate nonumber;
%mend FORMAL;

/***********************************************************
************************************************************
**      Office of Institutional Research & Planning       **
**                      SAS Macro                         **
**  ----------------------------------------------------  **
** Description:                                           **
**  For when you do not want to type in the pathname for  **
**  your output report. The extention parameter allows    **
**  you to add numbers or letters after the main name     **
**  segment in those cases where multiple reports are     **
**  being generated by the program in SAS for Windows     **
**  Enhanced Editor.                                      **
**  ----------------------------------------------------  **
** Created: 01/24/07                      By: R. Cherland **
************************************************************
***********************************************************/
%macro outpath(ext);
%unquote(%str(%')%substr(%sysget(SAS_EXECFILEPATH),1,%length(%sysget(SAS_EXECFILEPATH))-
4)&ext%str(%'))
%mend outpath
```