Communicating Uncertainty – An example using the SOC Approach to Reporting IPEDS HR Survey Data

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ABSTRACT

Beginning in fiscal year 2013, NCES mandated the use of SOC codes for submitting IPEDS HR Survey data. Consequently, institutions that previously submitted using other than SOC codes might need to apply, retroactively, the mandated FY2013 SOC approach to pre-FY2013 HR data in order to generate associated historical trends. This presentation discusses some ways in which the uncertainty introduced by this retroactive application might best be communicated to the university officers who routinely utilize these historical trends.

OUTLINE

- Motivating example using a specific metric (Ratio of Managers to Faculty)

- SOC's at UM

- Implications of ignoring uncertainty when reporting this metric

- Incorporating uncertainty using a Bayes-like approach when reporting this metric

- Suggested improvements

- Summary

Motivating Example

*** Refer to SOC handout NOW! ***

Fig 1.   UM IPEDS HR Survey employees.

FY	Total	No. Missing SOC	% Missing SOC
2010	28,108	1,126	4.01
2011	28,612	773	2.70
2012	28,852	208	0.72
2013	28,355	0	0.00

Fig 2.   Jobs (business_unit + jobcode) of UM IPEDS HR Survey employees.

FY	Total	No. Missing SOC	% Missing SOC
2010	3,435	415	12.08
2011	3,440	296	8.60
2012	3,446	159	4.61
2013	3,354	0	0.00

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Metric: $RATIO \equiv \dfrac{MGMNT}{TTTPSTCH} \cdot 100\%$

Fig 3. **Ratio of MGMNT to TTTPSTCH, UM IPEDS HR Survey employees, select UM academic departments, GRA/GA/GLA/GTA/GI's deleted.**

FY	Total	No. Missing SOC	% Missing SOC	No. MGMNT	No. TTTPSTCH	RATIO (%)
2010	2,411	25	1.04	38	1,068	3.56
2011	2,450	16	0.65	35	1,049	3.34
2012	2,472	1	0.04	37	1,077	3.44
2013	2,472	0	0.00	43	1,072	4.01

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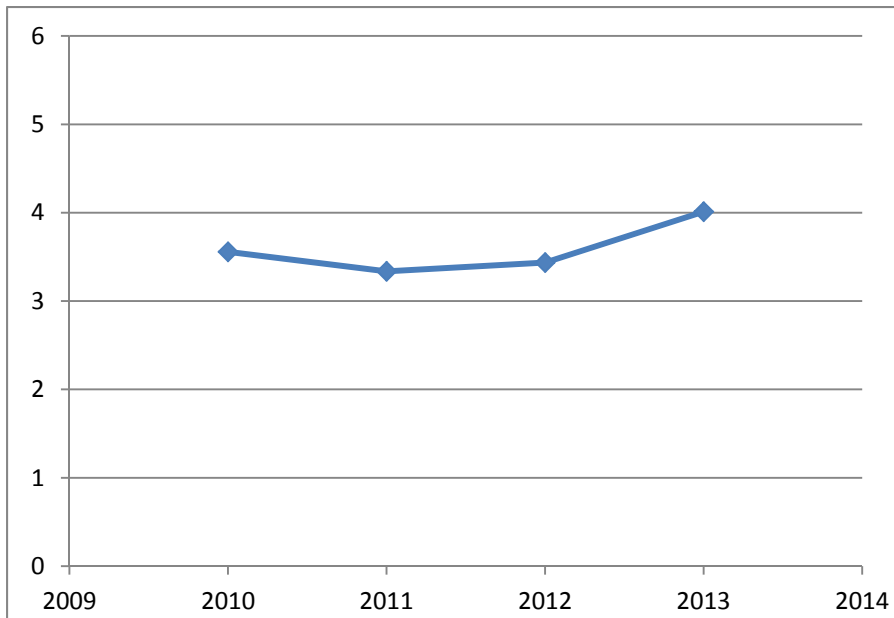
Metrics:
$$RATIO_{Min} \equiv \frac{MGMNT}{TTTPSTCH + MISSING} \cdot 100\%$$

$$RATIO_{Max} \equiv \frac{MGMNT + MISSING}{TTTPSTCH} \cdot 100\%$$

Fig 4. **Ratio of MGMNT to TTTPSTCH, UM IPEDS HR Survey employees, select UM academic departments, GRA/GA/GLA/GTA/GI's deleted.**

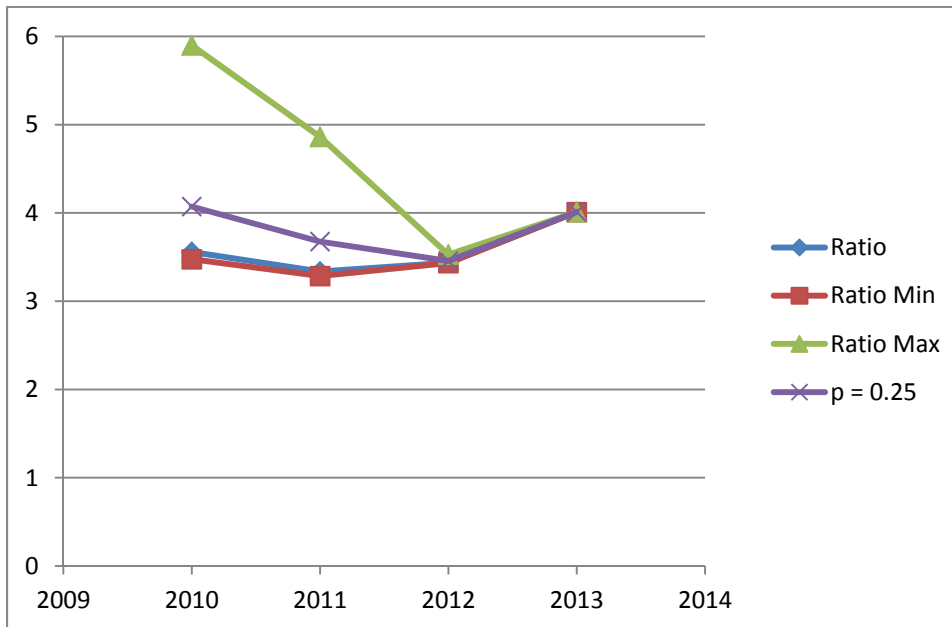| FY	No. Missing SOC	No. MGMNT	No. TTTPSTCH	RATIO$_{Min}$ (%)	RATIO (%)	RATIO$_{Max}$ (%)
2010	25	38	1,068	3.48	3.56	5.90
2011	16	35	1,049	3.29	3.34	4.86
2012	1	37	1,077	3.43	3.44	3.53
2013	0	43	1,072	4.01	4.01	4.01
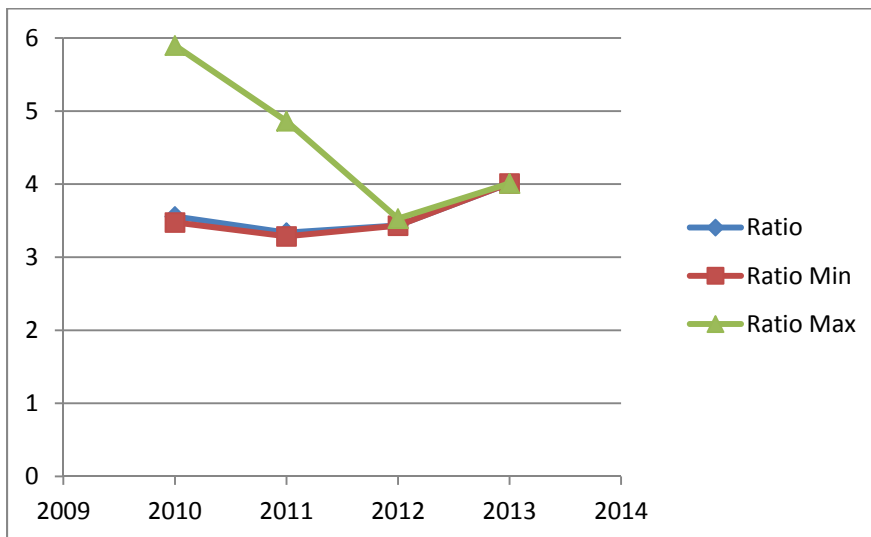
Metric:
$$RATIO_p \equiv \frac{MGMNT + p \cdot MISSING}{TTTPSTCH + (1-p) \cdot MISSING} \cdot 100\%, \text{ where}$$

$p \equiv$ proportion of $MISSING$ assigned to $MGMNT$.

Fig 5. Ratio of MGMNT to TTTPSTCH, UM IPEDS HR Survey employees, select UM academic departments, GRA/GA/GLA/GTA/GI's deleted.

FY	No. Missing SOC	No. MGMNT	No. TTTPSTCH	p	RATIO$_p$ (%)
2010	25	38	1,068	0.2500	4.07
2011	16	35	1,049	0.2500	3.68
2012	1	37	1,077	0.2500	3.46
2013	0	43	1,072	0.2500	4.01

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Metric: $$RATIO_{\theta} \equiv \frac{MGMNT + p \cdot MISSING}{TTTPSTCH + (1-p) \cdot MISSING} \cdot 100\% , \text{ where}$$

$$p \equiv \text{proportion of } MISSING \text{ assigned to } MGMNT.$$

A Bayes-like Solution:

For *each* FY:

1. Assign a probability distribution to p to represent your opinion (belief) about the relative amount of MISSING that should be assigned to MGMNT (*and, hence, to TTTPSTCH*).

2. Compute the "average" of the resulting random values of RATIO, to use as a best estimate.

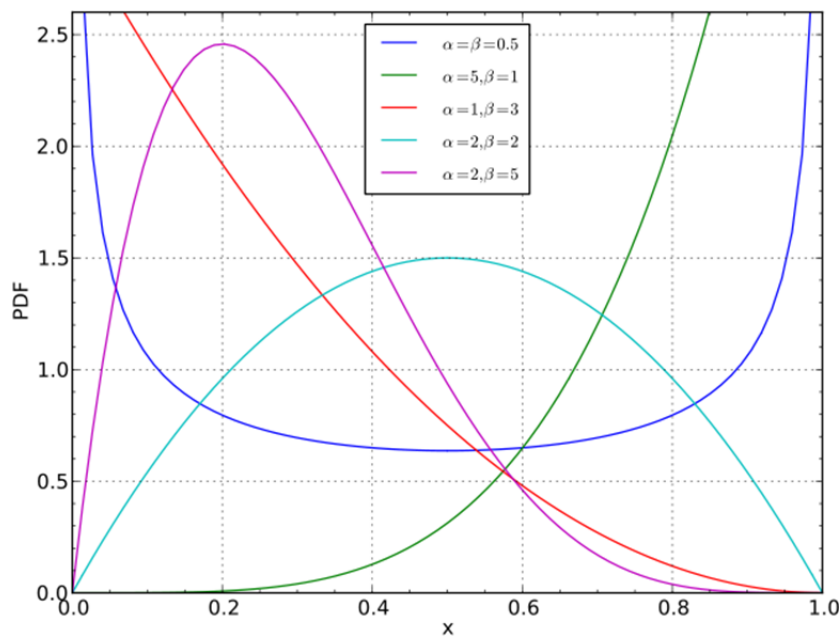3. Use appropriate quantiles of the resulting probability distribution of RATIO to form better "intervals."

*** Refer to Beta Distribution handout (next page) NOW! ***

Beta Distribution:

$$f(p|\alpha,\beta) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\cdot\Gamma(\alpha)} \cdot p^{\alpha-1}(1-p)^{\beta-1} \cdot I_{[0,1]}(p), \text{ where}$$

$$\alpha \geq 0, \ \beta \geq 0, \text{ and } \Gamma(t) \equiv \int_0^\infty u^{t-1}e^{-u}du.$$

Wikipedia

$$\mu_{p|\alpha,\beta} = Exp(p|\alpha,\beta) = \frac{\alpha}{\alpha+\beta}, \text{ and } Mode(p|\alpha,\beta) = \frac{\alpha-1}{\alpha+\beta-2}, \text{ and}$$

$$\sigma^2_{p|\alpha,\beta} = Var(p|\alpha,\beta) = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}.$$

Example:

Suppose you "believe" (for whatever reason) that, for a given FY:

- Each of these employees who have a missing SOC, either has a management occupation, or is a postsecondary teacher.

- Each is three times more likely to be a teacher than a manager.

Then, for each FY you want parameters alpha and beta to satisfy:

$$\mu_{p|\alpha,\beta} = Exp(p|\alpha,\beta) = \frac{\alpha}{\alpha+\beta} = 0.25 \text{ ,}$$

and the more confident you are in your belief, the more you would prefer values of alpha and beta that yield a smaller standard deviation:

$$\sigma_{p|\alpha,\beta} = \sqrt{\sigma^2_{p|\alpha,\beta}} = \sqrt{Var(p|\alpha,\beta)} = \frac{1}{\alpha+\beta} \cdot \sqrt{\frac{\alpha\beta}{\alpha+\beta+1}} \text{ .}$$

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alpha	beta	Exp(p)	StdDev(p)	Var(p)
0.5	1.5	0.25	0.2500	0.0625
1.0	3.0	0.25	0.1936	0.0375
2.0	6.0	0.25	0.1443	0.0208
4.0	12.0	0.25	0.1050	0.0110
8.0	24.0	0.25	0.0754	0.0057
16.0	48.0	0.25	0.0537	0.0029

Beta PDF's

$$f(p; a, b) = (1/Beta(a,b)) * (p^{**}(a-1)) * ((1-p)*(b-1)), \quad \text{for } 0 \le p \le 1$$

$$\text{Mean} = a / (a+b) = 0.25$$

Beta PDF's

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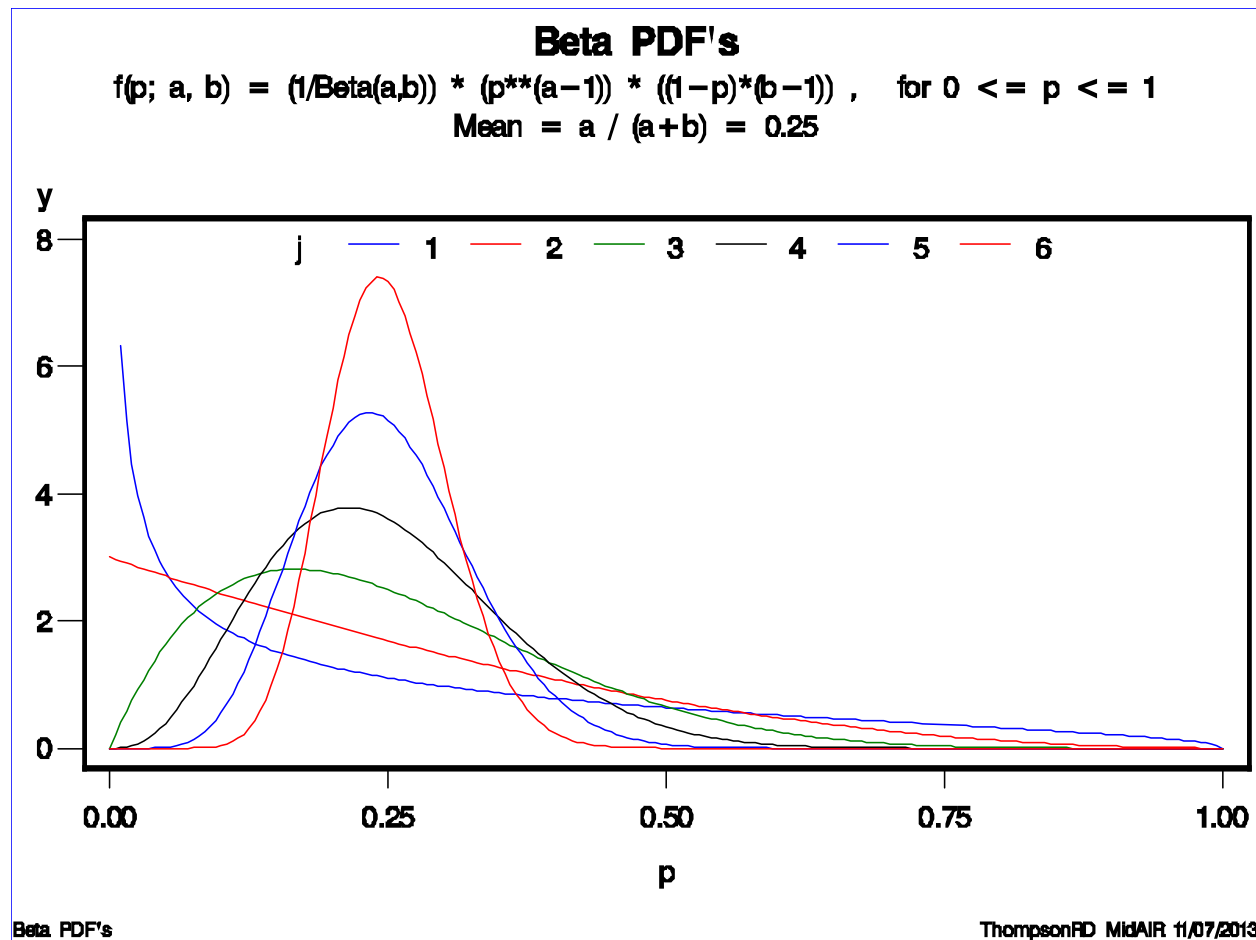
## Then, using alpha = 8.0 and beta = 24.0, our Bayes-like solution yields:

$$RATIO_{\alpha,\beta} \equiv \frac{MGMNT + p \cdot MISSING}{TTTPSTCH + (1-p) \cdot MISSING} \cdot 100\% \text{ , where}$$

$p \equiv$ proportion of *MISSING* assigned to *MGMNT* , and

$p \sim Beta(\alpha,\beta)$.

*** Refer to Excel worksheet handout NOW! ***

Fig 6. **Ratio of MGMNT to TTTPSTCH, UM IPEDS HR Survey employees, select UM academic departments, GRA/GA/GLA/GTA/GI's deleted. Bayes-like solution with p~Beta(alpha=8.0, beta=24.0).**

FY	No. Missing SOC	No. MGMNT	No. TTTPSTCH	P_{05}	$RATIO_{8,\ 24}$ (%)	P_{95}
2010	25	38	1,068	3.798	4.07	4.39
2011	16	35	1,049	3.497	3.68	3.89
2012	1	37	1,077	3.445	3.46	3.47
2013	0	43	1,072	4.01	4.01	4.01
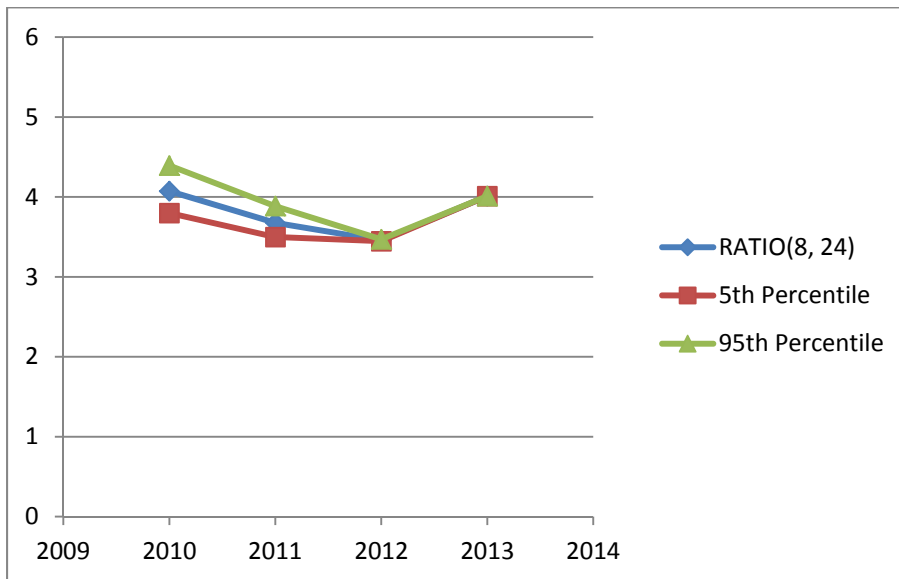
Remarks:

Even Better:

- Use <u>all</u> (non-graduate student) Postsecondary Teachers—not just Tenured/Tenure-Track—and...

- ... use FTE, rather than headcount.

- Because JOBCODES are reissued occasionally, assign SOC codes by matching on BUSINESS_UNIT + JOBCODE + *JOBCODE_DESCR*— rather than just BUSINESS_UNIT + JOBCODE. *But be especially careful re "conformed dimensions!"*

- Provide an *even better* solution by *not* assuming MISSING can *only* be either Managers or Postsecondary Teachers. [See Addendum.]

- Provide options for choosing values of the parameters. Here we used our prior belief to assign alpha = 8 and beta = 24.

Summary

- Illustrated the *necessity* of conveying uncertainty when reporting IR results to senior management.

  Used an example which utilizes the recent requirement to report IPEDS HR Survey data using SOC codes, and the challenge this requirement means when attempting to report historical trends.

- The example also demonstrated the importance of *how* the uncertainty is reported, by proposing a better approach, a Bayes-like approach.

- Listed refinements which should produce an even better result.

Addendum: An Even Better Bayes-like Solution

$$RATIO_{\beta_1, \beta_2, \beta_3} \equiv \frac{MGMNT + p_1 \cdot MISSING}{TTTPSTCH + p_2 \cdot MISSING} \cdot 100\% \ , \ \text{ where}$$

$p_1 \equiv$ proportion of $MISSING$ assigned to $MGMNT$,

$p_2 \equiv$ proportion of $MISSING$ assigned to $TTTPSTCH$,

$p_1 + p_2 \leq 1$, and

$(p_1, p_2) \sim Dirichlet(\beta_1, \beta_2, \beta_3)$.

For *each* FY:

1. Assign a joint probability distribution to (p_1, p_2) to represent your opinion (belief) about the relative amounts of MISSING that should be assigned to MGMNT and TTTPSTCH, respectively.

2. Compute the "average" of the resulting random values of RATIO, to use as a best estimate.

3. Use appropriate quantiles of the resulting probability distribution of RATIO to form better "intervals."

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Appendix (Handouts)

2010 Standard Occupational Classification

| Major | Minor | Broad Group | Detailed Occupation |

11-0000			**Management Occupations (MGMNT)**
	11-1000		**Top Executives**
	11-2000		**Advertising, Marketing, Promotions, Public Relations, and Sales Managers**
	11-3000		**Operations Specialties Managers**
	11-9000		**Other Management Occupations**
		11-9010	Farmers, Ranchers, and Other Agricultural Managers
		11-9020	Construction Managers
		11-9030	Education Administrators
			11-9031 Education Administrators, Preschool and Childcare Center/Program
			11-9032 Education Administrators, Elementary and Secondary School
			11-9033 Education Administrators, Postsecondary
			11-9039 Education Administrators, All Other
		11-9040	Architectural and Engineering Managers
		11-9050	Food Service Managers
		11-9060	Funeral Service Managers
		11-9070	Gaming Managers
		11-9080	Lodging Managers
		11-9110	Medical and Health Services Managers
		11-9120	Natural Sciences Managers
		11-9130	Postmasters and Mail Superintendents
		11-9140	Property, Real Estate, and Community Association Managers
		11-9150	Social and Community Service Managers
		11-9160	Emergency Management Directors
		11-9190	Miscellaneous Managers
25-0000			**Education, Training, and Library Occupations**
	25-1000		**Postsecondary Teachers (T/TT only, delete GRA/GA/GLA/GTA/GI's: TTTPSTEACH)**
		25-1010	Business Teachers, Postsecondary
		25-1020	Math and Computer Teachers, Postsecondary
		25-1030	Engineering and Architecture Teachers, Postsecondary
		25-1040	Life Sciences Teachers, Postsecondary
		25-1050	Physical Sciences Teachers, Postsecondary
		25-1060	Social Sciences Teachers, Postsecondary
		25-1070	Health Teachers, Postsecondary
		25-1080	Education and Library Science Teachers, Postsecondary
		25-1110	Law, Criminal Justice, and Social Work Teachers, Postsecondary
		25-1120	Arts, Communications, and Humanities Teachers, Postsecondary
		25-1190	Miscellaneous Postsecondary Teachers
			~~25-1191 Graduate Teaching Assistants~~
			25-1192 Home Economics Teachers, Postsecondary
			25-1193 Recreation and Fitness Studies Teachers, Postsecondary
			25-1194 Vocational Education Teachers, Postsecondary
			25-1199 Postsecondary Teachers, All Other
	25-2000		**Preschool, Primary, Secondary, and Special Education School Teachers**
	25-3000		**Other Teachers and Instructors**
	25-4000		**Librarians, Curators, and Archivists**
	25-9000		**Other Education, Training, and Library Occupations**

BUSINESS_UNIT	VCVP	VCVP_DESCR	CSD	CSD_DESCR	DEPT	DEPT_DESCR	DEPTID	DEPTID_DESCR	iAcademic_Depts
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CAEROSPA	Aerospace Studies	CAEROSPA	Aerospace Studies	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CAMRARCH	American Archaeology	CAMRARCH	American Archaeology	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CAMRARCH	American Archeology	CAMRARCH	American Archeology	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CANTHROP	Anthropology	CANTHROP	Anthropology	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CARTDEPT	Art	CARTDEPT	Art	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CARTHIST	Art History & Classical Archae	CARTHIST	Art History & Classical Archae	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CBIOLSCI	Biological Science	CBIOLSCI	Biological Science	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CBLKSTUD	Black Studies Program	CBLKSTUD	Black Studies Program	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CCHEMIST	Chemistry	CCHEMIST	Chemistry	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CCLASSTU	Classical Studies	CCLASSTU	Classical Studies	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CCOMMUNI	Communication	CCOMMUNI	Communication	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CDEANA&S	Dean Of Arts & Science	CDEANA&S	Dean Of Arts & Science	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CDEANA&S	Dean of Arts & Science	CDEANA&S	Dean of Arts & Science	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CECONOMI	Economics	CECONOMI	Economics	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CENGLISH	English	CENGLISH	English	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CGEOGRAP	Geography	CGEOGRAP	Geography	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CGEOLSCI	Geological Sciences	CGEOLSCI	Geological Sciences	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CGERMRUS	German & Russian Studies	CGERMRUS	German & Russian Studies	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CHISTORY	History	CHISTORY	History	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CMATHEMA	Mathematics	CMATHEMA	Mathematics	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CMILISCI	Military Science	CMILISCI	Military Science	0
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CMOREVIE	Missouri Review	CMOREVIE	Missouri Review	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CMUSART	Museum Of Art & Archaeology	CMUSART	Museum Of Art & Archaeology	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CMUSART	Museum of Art & Archaeology	CMUSART	Museum of Art & Archaeology	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CPHILOSO	Philosophy	CPHILOSO	Philosophy	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CPHYSICS	Physics	CPHYSICS	Physics	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CPOLISCI	Political Science	CPOLISCI	Political Science	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CPSYCHOL	Psychological Sciences	CPSYCHOL	Psychological Sciences	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CRELSTUD	Religious Studies	CRELSTUD	Religious Studies	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CROMLANG	Romance Languages & Literature	CROMLANG	Romance Languages & Literature	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CSCMUSIC	School Of Music	CSCMUSIC	School Of Music	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CSCMUSIC	School of Music	CSCMUSIC	School of Music	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CSOCIOLO	Sociology	CSOCIOLO	Sociology	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CSPECDEG	Special Degree Program	CSPECDEG	Special Degree Program	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CSTATIST	Statistics	CSTATIST	Statistics	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CTHEATRE	Theatre	CTHEATRE	Theatre	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CWOMENST	Women'S & Gender Studies	CWOMENST	Women'S & Gender Studies	1
COLUM	CPVST	Exec Vice Chancellor & Prov	CA&S	Arts & Science	CWOMENST	Women's & Gender Studies	CWOMENST	Women's & Gender Studies	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KACADVIS	Academic Advising	KACADVIS	Academic Advising	0
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KAGINGST	Center of Aging Studies	KAGINGST	Center of Aging Studies	0
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KAPLDLNG	Acad Affairs Applied Lang	KAPLDLNG	Acad Affairs Applied Lang	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KARCURBN	Archit& Urban Plan & Design	KARCURBN	Archit& Urban Plan & Design	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KART&AHS	Art & Art History	KART&AHS	Art & Art History	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KCHEMIST	Chemistry	KCHEMIST	Chemistry	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KCNTEDAS	Continuing Educ Pgms A & S	KCNTEDAS	Continuing Educ Pgms A & S	0
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KCOMMSTU	Communications Studies	KCOMMSTU	Communications Studies	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KCRIMJUS	Criminal Justice & Criminology	KCRIMJUS	Criminal Justice & Criminology	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KDEANA&S	Dean of Arts & Sciences	KDEANA&S	Dean of Arts & Sciences	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KECONOMI	Economics	KECONOMI	Economics	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KENGLLIT	English Language & Literature	KENGLLIT	English Language & Literature	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KFORNLIT	Foreign Languages & Literature	KFORNLIT	Foreign Languages & Literature	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KGEOSCIE	Geosciences	KGEOSCIE	Geosciences	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KGRADSW	Social Work	KGRADSW	Social Work	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KHISTORY	History	KHISTORY	History	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KMATHEMA	Mathematics	KMATHEMA	Mathematics	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KNEWLETT	New Letters	KNEWLETT	New Letters	0
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KPHILOSO	Philosophy	KPHILOSO	Philosophy	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KPHYSICS	Physics	KPHYSICS	Physics	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KPOLISCI	Political Sciences	KPOLISCI	Political Sciences	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KPSYCHOL	Psychology	KPSYCHOL	Psychology	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KSOCIOLO	Sociology/Criminal Justice & C	KSOCIOLO	Sociology/Criminal Justice & C	1
KCITY	KACAF	VC Academic Affairs	KA&S	College of Arts & Sciences	KTHEATRE	Theatre	KTHEATRE	Theatre	1

KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KACADVIS	Academic Advising	KACADVIS	Academic Advising	0
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KAGINGST	Center Of Aging Studies	KAGINGST	Center Of Aging Studies	0
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KAPLDLNG	Acad Affairs Applied Lang	KAPLDLNG	Acad Affairs Applied Lang	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KARCURBN	Archit& Urban Plan & Design	KARCURBN	Archit& Urban Plan & Design	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KART&AHS	Art & Art History	KART&AHS	Art & Art History	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KCHEMIST	Chemistry	KCHEMIST	Chemistry	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KCNTEDAS	Continuing Educ Pgms A & S	KCNTEDAS	Continuing Educ Pgms A & S	0
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KCOMMSTU	Communications Studies	KCOMMSTU	Communications Studies	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KCRIMJUS	Criminal Justice & Criminology	KCRIMJUS	Criminal Justice & Criminology	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KDEANA&S	Dean Of Arts & Sciences	KDEANA&S	Dean Of Arts & Sciences	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KECONOMI	Economics	KECONOMI	Economics	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KENGLLIT	English Language & Literature	KENGLLIT	English Language & Literature	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KFORNLIT	Foreign Languages & Literature	KFORNLIT	Foreign Languages & Literature	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KGEOSCIE	Geosciences	KGEOSCIE	Geosciences	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KGRADSW	Social Work	KGRADSW	Social Work	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KHISTORY	History	KHISTORY	History	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KMATHEMA	Mathematics	KMATHEMA	Mathematics	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KNEWLETT	New Letters	KNEWLETT	New Letters	0
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPHILOSO	Philosophy	KPHILOSO	Philosophy	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPHYSICS	Physics	KPHYSICS	Physics	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPHYSICS	Physics And Astronomy	KPHYSICS	Physics And Astronomy	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPHYSICS	Physics And Astronomy	KPHYSICS	Physics And Astronomy	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPOLISCI	Political Science	KPOLISCI	Political Science	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPOLISCI	Political Sciences	KPOLISCI	Political Sciences	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KPSYCHOL	Psychology	KPSYCHOL	Psychology	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KSOCIOLO	Sociology	KSOCIOLO	Sociology	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KSOCIOLO	Sociology/Criminal Justice & C	KSOCIOLO	Sociology/Criminal Justice & C	1
KCITY	KACAF	Vc Academic Affairs	KA&S	College Of Arts & Sciences	KTHEATRE	Theatre	KTHEATRE	Theatre	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RBIOLSCI	Biological Sciences	RBIOLSCI	Biological Sciences	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RBUSADMN	Business & Information Tech	RBUSADMN	Business & Information Tech	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RBUSADMN	Business & Information Tech	RBUSADMNOF	Business & Information Tech	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RBUSADMN	Business & Information Tech	RTECEXTLNG	Ctr For Technology Enh Learn	0
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RBUSADMN	Business & Information Tech	RTECEXTLNG	Ctr for Technology Enh Learn	0
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RCHEMENG	Chemical & Biochemical Engrg	RCHEMENG	Chemical & Biochemical Engrg	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RCHEMENG	Chemical & Biological Engineer	RCHEMENG	Chemical & Biological Engineer	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RCHEMIST	Chemistry	RCHEMSCIE	Chemistry	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RCHEMIST	Chemistry	RCLOUDLAB	Cloud & Aerosol Sciences Lab	0
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RCIVILEN	Civil, Arch & Environ Engr	RCIVILEN	Civil, Arch & Environ Engr	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RCOMPSCI	Computer Science	RCOMPSCI	Computer Science	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RECONOMI	Economics	RECONOMI	Economics	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RELECENG	Electrical & Computer Engineer	RELECENG	Electrical & Computer Engineer	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RENGLISH	English & Tech Communication	RENGLISH	English & Tech Communication	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RENGMNGT	Engineering Mgt & Sys Engr	RENGMNGT	Engineering Mgt & Sys Engr	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RGEOSENG	Geological Sciences & Engr	RGEOSENG	Geological Sciences & Engr	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RHISTORY	History & Political Science	REDUCPRGRM	Teacher Education Program	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RHISTORY	History & Political Science	RHISTORY	History & Political Science	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RHISTORY	History & Political Science	RHISTRYDEP	History & Political Science	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMATHEMA	Mathematics & Statistics	RMATHEMA	Mathematics & Statistics	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMATSENG	Materials Science & Engineerin	RMATSENG	Materials Science & Engineerin	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMATSENG	Materials Science & Engr	RMATSENGRG	Materials Science & Eng	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMECHENG	Mechanical & Aerospace Engin	RMECHENG	Mechanical & Aerospace Engin	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMILARMY	Military Science - Army	RMILARMY	Military Science - Army	0
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMILSCI	Military Science - Air Force	RMILSCI	Military Science - Air Force	0
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMINNUCL	Mining & Nuclear Engineering	RMINNUCL	Mining & Nuclear Engineering	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMINNUCL	Mining & Nuclear Engineering	RMINNUCLOF	Mining & Nuclear Engr	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RMINNUCL	Mining & Nuclear Engineering	RNUCLRCTOR	Nuclear Reactor	0
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RPHILOSO	Arts, Languages & Philosophy	RPHILOSO	Arts, Languages & Philosophy	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RPHYSICS	Physics	RPHYSICS	Physics	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RPSYCHOL	Psychological Science	RPSYCHOL	Psychological Science	1
ROLLA	RPRV	Provost	RA&ID	Academic&Instruction Depts	RPSYCHOL	Psychological Sciences	RPSYCHOL	Psychological Sciences	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SANTHROP	Anthropology	SANTHROP	Anthropology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SBIOLOGY	Biology	SBIOLOGY	Biology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SCACEN	Child Advocacy Center	SCACEN	Child Advocacy Center	0

STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SCHEMIST	Chemistry	SCHEMIST	Chemistry	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SCRIM&CJ	Criminology & Criminal Justice	SCRIM&CJ	Criminology & Criminal Justice	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SDEANA&S	Dean of Arts & Sciences	SDEANA&S	Dean of Arts & Sciences	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SECONOMI	Economics	SECONOMI	Economics	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SENGLISH	English	SENGLISH	English	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SFORLANG	Foreign Languages & Literature	SFORLANG	Foreign Languages & Literature	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SGERONTO	Gerontology	SGERONTO	Gerontology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SHISTORY	History	SHISTORY	History	1
~~STLOU~~	~~SACAF~~	~~VC for Academic Affairs~~	~~SA&S~~	~~College of Arts & Sciences~~	~~SIWGSTU~~	~~Institute for Women & Gender S~~	~~SIWGSTU~~	~~Institute for Women & Gender S~~	~~0~~
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SMATH&CS	Mathematics & Computer Science	SMATH&CS	Mathematics & Computer Science	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPHILOSO	Philosophy	SPHILOSO	Philosophy	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPHYASTR	Physics and Astronomy	SPHYASTR	Physics and Astronomy	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPOLISCI	Political Science	SPOLISCI	Political Science	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SPSYCHOL	Psychology	SPSYCHOL	Psychology	1
~~STLOU~~	~~SACAF~~	~~VC for Academic Affairs~~	~~SA&S~~	~~College of Arts & Sciences~~	~~SPSYCTR~~	~~Center for Trauma Recovery~~	~~SPSYCTR~~	~~Center for Trauma Recovery~~	~~0~~
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SSOCIOLO	Sociology	SSOCIOLO	Sociology	1
STLOU	SACAF	VC for Academic Affairs	SA&S	College of Arts & Sciences	SSOCWORK	Social Work	SSOCWORK	Social Work	1
~~STLOU~~	~~SACAF~~	~~Vc For Academic Affairs~~	~~SA&S~~	~~College Of Arts & Sciences~~	~~SA&SACAD~~	~~Academic Advising, Arts & Scie~~	~~SA&SACAD~~	~~Academic Advising, Arts & Scie~~	~~0~~
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SANTHROP	Anthropology	SANTHROP	Anthropology	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SBIOLOGY	Biology	SBIOLOGY	Biology	1
~~STLOU~~	~~SACAF~~	~~Vc For Academic Affairs~~	~~SA&S~~	~~College Of Arts & Sciences~~	~~SCACEN~~	~~Child Advocacy Center~~	~~SCACEN~~	~~Child Advocacy Center~~	~~0~~
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SCHEMIST	Chemistry	SCHEMIST	Chemistry	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SCRIM&CJ	Criminology & Criminal Justice	SCRIM&CJ	Criminology & Criminal Justice	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SDEANA&S	Dean Of Arts & Sciences	SDEANA&S	Dean Of Arts & Sciences	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SECONOMI	Economics	SECONOMI	Economics	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SENGLISH	English	SENGLISH	English	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SFORLANG	Foreign Languages & Literature	SFORLANG	Foreign Languages & Literature	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SGERONTO	Gerontology	SGERONTO	Gerontology	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SHISTORY	History	SHISTORY	History	1
~~STLOU~~	~~SACAF~~	~~Vc For Academic Affairs~~	~~SA&S~~	~~College Of Arts & Sciences~~	~~SIWGSTU~~	~~Institute For Women & Gender S~~	~~SIWGSTU~~	~~Institute For Women & Gender S~~	~~0~~
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SIWGSTU	Program In Gender Studies	SIWGSTU	Program In Gender Studies	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SMATH&CS	Mathematics & Computer Science	SMATH&CS	Mathematics & Computer Science	1
~~STLOU~~	~~SACAF~~	~~Vc For Academic Affairs~~	~~SA&S~~	~~College Of Arts & Sciences~~	~~SMILSCIE~~	~~Military Science~~	~~SMILSCIE~~	~~Military Science~~	~~0~~
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SPHILOSO	Philosophy	SPHILOSO	Philosophy	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SPHYASTR	Physics And Astronomy	SPHYASTR	Physics And Astronomy	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SPOLISCI	Political Science	SPOLISCI	Political Science	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SPSYCHOL	Psychology	SPSYCHOL	Psychology	1
~~STLOU~~	~~SACAF~~	~~Vc For Academic Affairs~~	~~SA&S~~	~~College Of Arts & Sciences~~	~~SPSYCTR~~	~~Center For Trauma Recovery~~	~~SPSYCTR~~	~~Center For Trauma Recovery~~	~~0~~
~~STLOU~~	~~SACAF~~	~~Vc For Academic Affairs~~	~~SA&S~~	~~College Of Arts & Sciences~~	~~SPSYSERV~~	~~Psychological Services~~	~~SPSYSERV~~	~~Psychological Services~~	~~0~~
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SSOCIOLO	Sociology	SSOCIOLO	Sociology	1
STLOU	SACAF	Vc For Academic Affairs	SA&S	College Of Arts & Sciences	SSOCWORK	Social Work	SSOCWORK	Social Work	1

	A	B	C	D	E	F	G	H	I	J	K
1											
2				Alpha =		8.000000		MISSING =	25.000	16.000	1.000
3				Beta =		24.000000		MGMNT =	38.000	35.000	37.000
4								TTTPSTCH =	1068.000	1049.000	1077.000
5											
6		U(0,1)		alpha	beta	BETA(alpha, beta)			FY2010	FY2011	FY2012
7		0.135552		8.000	24.000	0.167708			3.875	3.547	3.448
8		0.819914		8.000	24.000	0.318852			4.237	3.784	3.463
9		0.857338		8.000	24.000	0.331974			4.268	3.804	3.464
10		0.152702		8.000	24.000	0.172512			3.887	3.555	3.449
11		0.054272		8.000	24.000	0.137641			3.803	3.500	3.445
12		0.477606		8.000	24.000	0.240462			4.049	3.661	3.455
100001											
100002											
100003											
100004		0.871587		8.000	24.000	0.337626			4.282	3.813	3.465
100005		0.085690		8.000	24.000	0.151340			3.836	3.522	3.447
100006		0.377792		8.000	24.000	0.221468			4.004	3.631	3.454
100007		0.768387		8.000	24.000	0.303557			4.200	3.760	3.461
100008		0.430607		8.000	24.000	0.231536			4.028	3.647	3.455
100009		0.049200		8.000	24.000	0.134967			3.797	3.496	3.445
100010											
100011	MEAN	0.499		8.000	24.000	0.250			4.072	3.676	3.456
100012	STD DEV	0.289		0.000	0.000	0.075			0.181	0.118	0.007
100013	P05	0.051		8.000	24.000	0.136			3.799	3.498	3.445
100014	P95	0.951		8.000	24.000	0.383			4.392	3.885	3.469