



University of Missouri System

**UNIVERSITY OF MISSOURI RETIREMENT, DISABILITY AND
DEATH BENEFIT PLAN**

Actuarial Valuation as of October 1, 2018

Copyright © 2019
THE SEGAL GROUP, INC.
ALL RIGHTS RESERVED



333 West 34th Street New York, NY 10001-2402
T 212.251.5000 F 646.365.3243 www.segalco.com

DIRECT DIAL NUMBER
(212) 251-5173

E-MAIL ADDRESS
jkaplan@segalco.com

March 4, 2019

Board of Curators
University of Missouri
Columbia, MO 65211

Dear Curators:

We are pleased to submit this report on our actuarial valuation of the University of Missouri Retirement, Disability, and Death Benefit Plan as of October 1, 2018. Our actuarial valuation is based on the current actuarial assumptions and provisions of the Plan, membership and financial data as of October 1, 2018.

The actuarial valuation was performed in accordance with accepted actuarial procedures under the supervision of the undersigned.

We look forward to meeting with your representatives to review this report on our 2018 actuarial valuation of the University's Plan.

Sincerely,

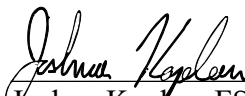
By 
Joshua Kaplan, FSA, FCA, MAAA, EA
Vice President and Actuary

TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION	
Active and Inactive Membership	2
Retired Members and Beneficiaries.....	2
Assets	3
Results of the Actuarial Valuation.....	3
Actuarial Accrued Liability	4
Analysis of Actuarial Experience	6
Changes in Actuarial Assumptions Since Previous Year	7
Changes in Plan Provisions Since Previous Year	7
Changes in Plan Contribution Requirements Since Previous Year	8
Changes in Unfunded Actuarial Liabilities Since Previous Year.....	8
Risk	9
II. PARTICIPANT AND PLAN STATISTICAL INFORMATION	11
III. SUMMARY OF PRINCIPAL PLAN PROVISIONS	31
IV. ACTUARIAL ASSUMPTIONS AND METHODS.....	37
V. ACCOUNTING INFORMATION	43
VI. ACTUARIAL VALUATION STATEMENT	44

I. INTRODUCTION

Actuarial valuations of the University of Missouri Retirement, Disability, and Death Benefit Plan are prepared annually. The basic purpose of annual actuarial valuations is to determine the Plan's actuarial liabilities and the contribution rates required to fund the Plan on an actuarial reserve basis.

The October 1, 2018 actuarial valuation of the Plan is based on five basic elements:

1. The present provisions of the Plan (see Section III).
2. The characteristics of active and inactive members.
3. The characteristics of retired members, beneficiaries and survivors.
4. The adopted actuarial assumptions and methods (see Section IV).
5. The actuarial value of the Plan's Trust assets, which on October 1, 2018 amounted to \$3,668,671,608.

The actuarial valuation report as of October 1, 2018 is based on financial information as of that date. Changes in the value of assets subsequent to that date are not reflected.

The Board of Curators adopted changes in plan benefit applicable to employees hired on or after October 1, 2012 (also known as Level Two Members). There are 8,634 active employees as of the valuation date (October 1, 2018) who are impacted by these plan benefit changes. The October 1, 2018 valuation determines the contribution requirements for the University's fiscal year July 1, 2019 – June 30, 2020. This valuation reports the contribution requirements separately for Level One Members (hired prior to October 1, 2012) and Level Two Members (hired on or after October 1, 2012).

Active and Inactive Membership

(Tables 1 through 3 - Section II)

A total of 22,919 active and inactive members of the University are included in this 2018 actuarial valuation. Approximately 65.7% of the active members are academic and administrative employees and 34.3% are clerical and service employees.

	Academic and Administrative	Clerical and Service	Total Employees
Active members	11,899	6,203	18,102
Inactive members	<u>3,380</u>	<u>1,437</u>	<u>4,817</u>
Total active and inactive members	15,279	7,640	22,919

The average annual salaries of academic and administrative employees increased by 3.1% to \$80,794 and clerical and service employees increased by 3.4% to \$36,444. Note that these figures reflect that a net of 208 employees were reclassified from clerical and service to academic and administrative. For the total actives, average salary was up 3.7% from the prior year.

The number and payrolls of active members are shown below:

	Academic and Administrative		Clerical and Service		Total	
	Number	Payroll	Number	Payroll	Number	Payroll
Level One	6,480	\$567,546,183	2,988	\$120,065,600	9,468	\$687,611,783
Level Two	<u>5,419</u>	<u>393,823,742</u>	<u>3,215</u>	<u>105,998,989</u>	<u>8,634</u>	<u>499,822,731</u>
Total	11,899	\$961,369,925	6,203	\$226,064,589	18,102	\$1,187,434,514

Retired Members and Beneficiaries

(Tables 4 through 7 - Section II)

There were 884 retirements during the year ending September 30, 2018.

On October 1, 2018, the Plan was paying benefits to a total of 10,316 members (including 9,375 pensioners and 941 beneficiaries and survivors). The total number of benefit recipients increased 5.7% from 9,763 on October 1, 2017. The 9,375 pensioners were comprised of 5,827 academic

and administrative and 3,548 clerical and service. Additionally, 20 former spouses were in payment status as of the valuation date.

As of October 1, 2018, the average annual benefit payable to retirees was \$28,302 for academic and administrative and \$11,607 for clerical and service, compared to \$27,854 and \$11,184, respectively, as of October 1, 2017. The average annual benefit payable to beneficiaries was \$15,748 as of October 1, 2018, compared to \$15,155 as of October 1, 2017. These average benefit amounts and the amounts shown in the tables that follow include all post-retirement benefit increases but exclude the portion of the benefits that were paid out in lump sums.

Assets

(Tables 8 through 9 - Section II)

As of September 30, 2018, net assets totalled \$3,684,544,817 at market value. For purposes of determining the actuarially required contributions, the value of assets is determined under a method utilizing expected investment return ("Expected Return Asset Valuation Method") but shall not be less than 80% nor greater than 120% of the market value. The value of assets used for actuarial valuation purposes (actuarial value of assets) using this methodology as of October 1, 2018 is \$3,668,671,608 and is 99.6% of market value.

Results of the Actuarial Valuation

(Tables 10 through 13 - Section II)

Under the entry age normal cost funding method, the total actuarially determined contribution rate consists of the normal cost plus the payment required to amortize the unfunded actuarial accrued liability over the established amortization period. Actuarial gains and losses resulting from differences between actual and assumed experience are recognized immediately in the Plan's actuarial accrued liabilities.

In general terms, the normal cost is the cost of benefit rights accruing on the basis of current service. Technically, the normal cost rate is the level percentage-of-salary contribution required

each year, with respect to each employee, to accumulate over his or her projected working lifetime the reserves needed to meet the cost of earned benefits. The normal cost represents the ultimate percentage-of-salary cost of the Plan if the current unfunded actuarial accrued liability is paid down and the actual experience of the Plan conforms to the assumptions.

The normal costs as of October 1, 2018 are calculated separately for employees under Level One and Level Two, and separately for academic and administrative employees, and clerical and service employees.

Actuarially Determined Normal Costs for Level One Employees

	Academic and Administrative	Clerical and Service	Total
Normal Cost - Dollar	\$40,871,211	\$7,750,526	\$48,621,737
Normal Cost - % of payroll	7.20%	6.46%	7.07%

Actuarially Determined Normal Costs for Level Two Employees

	Academic and Administrative	Clerical and Service	Total
Normal Cost - Dollar	\$13,510,924	\$3,111,215	\$16,622,139
Normal Cost - % of payroll	3.43%	2.94%	3.33%

Actuarial Accrued Liability

The total actuarial accrued liability represents the amount that would have been accumulated as of October 1, 2018 if contributions sufficient to meet the normal costs of the Plan had been made each year in the past and experience always conformed to the actuarial assumptions. If assets exactly equal the total actuarial accrued liability, there is no unfunded liability and future contribution requirements would consist solely of the calculated normal cost rates.

As of October 1, 2018, the actuarial value of assets of the Plan (\$3,668,671,608) fell short of the actuarial accrued liability (\$4,466,918,650) by \$798,247,042. The unfunded actuarial liability is

being recognized for funding purposes assuming it is to be amortized over a period of 25 years from the October 1, 2018 valuation date. The method of amortizing is the level dollar method, under which the dollar amounts of calculated amortization charges remain level over the amortization period.

Based on the above amortization method, the annual unfunded accrued liability funding contribution is \$67,535,898, representing 5.69% of total payroll for all employees. As shown on the following page, this compares to \$61,615,907 (5.37% of payroll) as of October 1, 2017. This increase is primarily due to a net actuarial experience loss. Employee contributions as a percentage of payroll for Level One and Level Two are projected to be 1.36% and 1.25%, respectively. Therefore, the net employer cost is 11.40% for Level One employees and 7.76% for Level Two employees.

There is no single all-encompassing test for measuring a Plan's funding progress and current funded status. In addition to comparing the valuation assets to the actuarial accrued liabilities and the pattern of the unfunded actuarial liability over time, another useful measure is the ratio of the plan's assets to the present value of accrued benefits computed as if the Plan were frozen on the valuation date and annuities were able to be purchased at the valuation assumptions. The market value of the Plan's assets as of October 1, 2018 is \$3,684,544,817, which is less than the present value of the Plan's accrued benefits of \$3,792,279,615. Therefore, the Plan's frozen liabilities were 97.2% funded as of that valuation date. If the Plan were actually to be terminated and annuities purchased from an insurance company, the purchase price of such annuities would be significantly greater than \$3,792,279,615 because the current annuity market interest rates are well below the 7.20% assumed investment rate assumption (as well as the additional loads for administrative and risk charges).

The following tables summarize the membership demographics and contribution requirements described on the previous page:

	As of October 1, 2018	As of October 1, 2017
Membership		
1. Active members	18,102	18,135
2. Inactive vested members	4,817	4,659
3. Pensioners and beneficiaries	<u>10,316</u>	<u>9,763</u>
4. Total membership	33,235	32,557
5. Compensation of active members	\$1,187,434,514	\$1,146,835,961

Contribution Requirements	As of October 1, 2018			As of October 1, 2017		
	Total Plan	Level One	Level Two	Total Plan	Level One	Level Two
	Dollar	% of pay	% of pay	Dollar	% of pay	% of pay
1. Normal cost	\$65,243,876	7.07%	3.33%	\$65,979,258	7.12%	3.32%
2. Total costs (including amortization of unfunded liability):						
(a) 25-year funding*	132,779,773	12.76%	9.01%	127,595,159	12.50%	8.69%
(b) 20-year funding	139,353,064	13.31%	9.57%	134,561,177	13.10%	9.30%
(c) 10-year funding	176,329,427	16.43%	12.68%	168,779,741	16.09%	12.28%
3. Expected employee contribution	15,595,741	1.36%	1.25%	14,908,183	1.34%	1.23%
4. Net employer contribution (25-year* funding)	\$117,184,032	11.40%	7.76%	\$112,686,976	11.16%	7.46%

* 26-year funding as of October 1, 2017

Analysis of Actuarial Experience

Investment Experience. During the year ending September 30, 2018, the total actuarial rate of investment return on the prior actuarial value was 6.32%, or 0.88% less than the assumed long-term rate of 7.20% per year. As a result of this investment experience, an actuarial loss of \$31.0 million was incurred. In turn, the amortization percentages as of October 1, 2018 were higher than they would have been if the investment returns rate had equalled the assumed rate. For

example, under the University's 25-year amortization policy, the resulting annual cost increase as a result of the investment experience was \$2,620,250, or 0.22% of payroll.

Demographic Changes. The aggregate employer normal cost rate between the 2017 and 2018 actuarial valuations decreased as a result of newly hired employees being covered by the lower Level Two plan of benefits. In addition, there were changes in both the demographic characteristics of employees and the distribution of employees between academic and administrative, and clerical and service.

Retirement Experience. During the year ended September 30, 2018, the number of retirements among both academic and administrative employees, and the clerical and service staff, were greater than expected.

Salary Experience. As explained on page 2, between the 2017 and 2018 actuarial valuations, the average salary increased by 3.1% for academic and administrative employees and increased by 3.4% for clerical and service employees. However, for actuarial experience purposes, only those employees who were active in both years are considered. In particular, the average salary of previously active academic and administrative employees increased 4.9% and the average salary of previously active clerical and service employees increased 5.5%. These actual salary increase patterns were greater than the assumed increases producing an actuarial loss of \$16.7 million. This translated to a 0.12% of payroll cost increase under the 25-year amortization policy.

Changes in Actuarial Assumptions Since Previous Year

The actuarial assumptions and cost methods used in this 2018 actuarial valuation are the same as those used in last year's valuation.

Changes in Plan Provisions Since Previous Year

There were no plan changes reflected in this actuarial valuation.

Changes in Plan Contribution Requirements Since Previous Year

	<u>Dollar Amounts</u>	<u>Percent of Payroll</u>
Total cost as of October 1, 2017	\$127,595,159	11.13%
Changes due to:		
Change due to increased payroll	2,335,698	(0.18)
Shift to Level Two plus other demographic changes	(3,071,080)	(0.26)
Loss/(gain) from actuarial experience and contributions	5,919,996	0.49
Total change:	\$5,184,614	0.05%
Total cost as of October 1, 2018	\$132,779,773	11.18%*

*The total costs for Level One and Level Two employees are 12.76% and 9.01% of payroll, respectively.

Changes in Unfunded Actuarial Liabilities Since Previous Year

Unfunded actuarial liabilities as of October 1, 2017	\$738,711,563
Changes due to:	
Loss (gain) from actuarial experience and contributions	
– Investment return:	\$30,970,291
– Salary increases:	16,657,918
– Other:	11,907,270
Total change:	\$59,535,479
Unfunded actuarial liabilities as of October 1, 2018	\$798,247,042

Risk

Since the actuarial valuation results are dependent on a given set of assumptions and data as of a specific date, there is a risk that emerging results may differ significantly as actual experience differs from the assumptions.

This report does not contain a detailed analysis of the potential range of future measurements, but does include a brief discussion of some risks that may affect the Plan. Upon request, a more detailed assessment of the risks can be provided to enable a better understanding of the risks specific to your Plan.

➤ Investment Risk (the risk that returns will be different than expected)

To illustrate the impact of investment experience on annual funding requirements, if the current year's actuarial value were 10% lower, the recommended net employer contribution of \$117,184,032 would have increased by \$31,038,891 to \$148,222,923.

The market value rate of return over the last 10 years has ranged from a low of -1.86% to a high of 13.70%.

➤ Longevity Risk (the risk that mortality experience will be different than expected)

The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.

➤ Demographic Risk (the risk that participant experience will be different than assumed)

Examples of this risk include:

- Actual retirements occurring earlier or later than assumed. The value of retirement plan benefits is sensitive to the rate of benefit accruals and any early retirement subsidies that may apply.
- More or less active participant turnover than assumed.

➤ Actual Experience Over the Last 10 years and Implications for the Future

Past experience can help demonstrate the sensitivity of key results to the Plan's actual experience. Over the past ten years:

The investment gain(loss) for a year has ranged from a loss of \$308 million to a gain of \$141 million.

The non-investment gain(loss) for a year has ranged from a loss of \$29 million to a gain of \$41 million.

The funded percentage on the actuarial value of assets has ranged from high of 100.8% as of October 1, 2009 to a low of 82.1% as of October 1, 2018.

➤ Maturity Measures

As pension plans mature, the cash needed to fulfill benefit obligations will increase over time. Therefore, cash flow projections and analysis should be performed to assure that the Plan's asset allocation is aligned to meet emerging pension liabilities.

Currently, the Plan has a non-active to active participant ratio of 0.84. For the prior year, benefits and expenses paid were approximately \$147.8 million greater than contributions received. As the Plan matures, more cash will be needed from the investment portfolio to meet benefit payments.

II. PARTICIPANT AND PLAN STATISTICAL INFORMATION

This section of the report provides background statistical information describing the demographic characteristics of the Plan's members, retirees and beneficiaries, income and expenses, assets and the details of our actuarial calculations.

<u>Description of Tables</u>	<u>Reference</u>	<u>Page</u>
Number, Average Age-Service-Salary, and Total Payroll of Active Members included in Actuarial Valuations		
- Level One Employees	Table 1A	12
- Level Two Employees	Table 1B	13
- All Employees	Table 1C	14
Employee Distribution by Age and Years of Service		
- Level One Academic and Administrative Employees	Table 2A	15
- Level One Clerical and Service Employees	Table 2B	16
- Level Two Academic and Administrative Employees	Table 2C	17
- Level Two Clerical and Service Employees	Table 2D	18
Salary Distributions		
- Level One Employees	Table 3A	19
- Level Two Employees	Table 3B	20
Pensions in Force by Monthly Amount	Table 4	21
Pensions in Force by Age	Table 5	22
Pensions Awarded by Monthly Amount	Table 6	23
Pensions Awarded by Age	Table 7	24
Development of Actuarial Value of Assets	Table 8	25
Statement of Income and Disbursements	Table 9	26
Determination of the Unfunded Actuarial Accrued Liability	Table 10	27
History of Unfunded (Overfunded) Actuarial Accrued Liability	Table 11	28
History of Percent Funded	Table 12	29
Actuarially Determined Contribution Rates	Table 13	30

Table 1A

**Number, Average Age-Service-Salary, and Total Payroll
of Level One Active Members Included in Actuarial Valuations**

Item	Actuarial Valuation as of October 1:				
	2014	2015	2016	2017	2018
ACADEMIC AND ADMINISTRATIVE					
Number	9,325	8,418	7,672	7,063	6,480
Average age	48.5	49.2	50.1	50.6	51.0
Average years of service	12.7	13.5	14.5	15.5	16.2
Average annual salary*	\$78,940	\$81,384	\$83,412	\$84,663	\$87,584
Total payroll (millions).....	\$736.1	\$685.1	\$639.9	\$598.0	\$567.5
CLERICAL AND SERVICE					
Number	5,413	4,703	4,073	3,534	2,988
Average age	47.6	48.7	49.7	50.4	50.8
Average years of service	12.3	13.4	14.5	15.5	16.1
Average annual salary*	\$35,465	\$36,749	\$37,852	\$38,289	\$40,183
Total payroll (millions).....	\$192.0	\$172.8	\$154.2	\$135.3	\$120.1
TOTAL EMPLOYEES					
Number	14,738	13,121	11,745	10,597	9,468
Average age	48.2	49.0	50.0	50.6	50.9
Average years of service	12.5	13.4	14.5	15.5	16.2
Average annual salary*	\$62,972	\$65,385	\$67,612	\$69,198	\$72,625
Total payroll (millions).....	\$928.1	\$857.9	\$794.1	\$733.3	\$687.6

Note: Detailed figures may not add to totals shown due to rounding.

* Based on annual compensation at valuation date.

University of Missouri

Table 1B

**Number, Average Age-Service-Salary, and Total Payroll
of Level Two Active Members Included in Actuarial Valuations**

Item	Actuarial Valuation as of October 1:				
	2014	2015	2016	2017	2018
ACADEMIC AND ADMINISTRATIVE					
Number	2,271	3,281	4,068	4,714	5,419
Average age	36.8	37.1	37.6	37.9	38.2
Average years of service	0.9	1.3	1.6	2.0	2.4
Average annual salary*	\$61,966	\$64,225	\$67,645	\$68,918	\$72,675
Total payroll (millions)	\$140.7	\$210.7	\$275.2	\$324.9	\$393.8
CLERICAL AND SERVICE					
Number	1,398	2,043	2,420	2,824	3,215
Average age	34.5	34.7	35.1	35.6	36.2
Average years of service	0.9	1.2	1.6	1.9	2.1
Average annual salary*	\$29,055	\$29,929	\$31,043	\$31,398	\$32,970
Total payroll (millions)	\$40.6	\$61.1	\$75.1	\$88.7	\$106.0
TOTAL EMPLOYEES					
Number	3,669	5,324	6,488	7,538	8,634
Average age	36.0	36.2	36.7	37.1	37.5
Average years of service	0.9	1.2	1.6	2.0	2.3
Average annual salary*	\$49,426	\$51,064	\$53,993	\$54,862	\$57,890
Total payroll (millions)	\$181.3	\$271.9	\$350.3	\$413.5	\$499.8

Note: Detailed figures may not add to totals shown due to rounding.

* Based on annual compensation at valuation date.

University of Missouri

Table 1C

**Number, Average Age-Service-Salary, and Total Payroll
of Active Members Included in Actuarial Valuations**

Item	Actuarial Valuation as of October 1:				
	2014	2015	2016	2017	2018
ACADEMIC AND ADMINISTRATIVE					
Number	11,596	11,699	11,740	11,777	11,899
Average age	46.2	45.8	45.8	45.6	45.2
Average years of service	10.4	10.0	10.1	10.1	9.9
Average annual salary*	\$75,616	\$76,572	\$77,949	\$78,361	\$80,794
Total payroll (millions)	\$876.8	\$895.8	\$915.1	\$922.9	\$961.4
CLERICAL AND SERVICE					
Number	6,811	6,746	6,493	6,358	6,203
Average age	45.0	44.5	44.3	43.8	43.2
Average years of service	9.9	9.7	9.7	9.5	8.8
Average annual salary*	\$34,149	\$34,683	\$35,314	\$35,229	\$36,444
Total payroll (millions)	\$232.6	\$234.0	\$229.3	\$224.0	\$226.1
TOTAL EMPLOYEES					
Number	18,407	18,445	18,233	18,135	18,102
Average age	45.8	45.3	45.2	45.0	44.5
Average years of service	10.2	9.9	9.9	9.9	9.5
Average annual salary*	\$60,272	\$61,251	\$62,766	\$63,239	\$65,597
Total payroll (millions)	\$1,109.4	\$1,129.8	\$1,144.4	\$1,146.8	\$1,187.4

Note: Detailed figures may not add to totals shown due to rounding.

* Based on annual compensation at valuation date.

University of Missouri

Table 2A

Employee Distribution by Age and Years of Service

**Level One Academic and Administrative
As of October 1, 2018**

Age	Total	Years of Service								
		Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 and over
Total.....	6,480	71	1,650	1,656	1,248	818	513	341	125	58
25 - 29.....	49	5	42	2	0	0	0	0	0	0
30 - 34.....	376	6	302	68	0	0	0	0	0	0
35 - 39.....	718	9	344	310	54	1	0	0	0	0
40 - 44.....	821	15	272	309	183	42	0	0	0	0
45 - 49.....	992	10	217	334	262	137	30	2	0	0
50 - 54.....	1,044	13	163	238	280	190	112	48	0	0
55 - 59.....	1,108	1	138	182	237	218	187	105	38	2
60 - 64.....	871	7	119	145	166	155	121	111	41	6
65 - 69.....	358	5	42	51	51	55	49	53	34	18
70 and over	143	0	11	17	15	20	14	22	12	32

University of Missouri

Table 2B

Employee Distribution by Age and Years of Service

**Level One Clerical and Service
As of October 1, 2018**

Age	Total	Years of Service								
		Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 and over
Total.....	2,988	19	779	814	572	349	221	145	59	30
25 - 29.....	58	0	56	2	0	0	0	0	0	0
30 - 34.....	193	1	144	48	0	0	0	0	0	0
35 - 39.....	297	5	121	133	37	1	0	0	0	0
40 - 44.....	278	2	72	115	55	33	1	0	0	0
45 - 49.....	425	1	95	126	101	66	36	0	0	0
50 - 54.....	517	3	91	122	115	86	56	41	3	0
55 - 59.....	678	5	106	149	162	80	80	57	33	6
60 - 64.....	435	1	75	92	85	67	36	39	20	20
65 - 69.....	88	1	16	25	11	13	9	7	3	3
70 and over	19	0	3	2	6	3	3	1	0	1

University of Missouri

Table 2C

Employee Distribution by Age and Years of Service

**Level Two Academic and Administrative
As of October 1, 2018**

Age	Total	Years of Service								
		Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 and over
Total.....	5,419	4,843	574	0	0	0	0	0	0	0
20 - 24.....	346	346	0	0	0	0	0	0	0	0
25 - 29.....	1,050	995	55	0	0	0	0	0	0	0
30 - 34.....	1,210	1,097	113	0	0	0	0	0	0	0
35 - 39.....	886	778	108	0	0	0	0	0	0	0
40 - 44.....	595	501	94	0	0	0	0	0	0	0
45 - 49.....	440	378	62	0	0	0	0	0	0	0
50 - 54.....	329	288	41	0	0	0	0	0	0	0
55 - 59.....	284	239	45	0	0	0	0	0	0	0
60 - 64.....	189	154	35	0	0	0	0	0	0	0
65 - 69.....	68	52	16	0	0	0	0	0	0	0
70 and over.....	22	15	7	0	0	0	0	0	0	0

University of Missouri

Table 2D

Employee Distribution by Age and Years of Service

**Level Two Clerical and Service
As of October 1, 2018**

Age	Total	Years of Service									
		Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 and over	
Total.....	3,215	2,972	243	0	0	0	0	0	0	0	0
Under 20.....	30	30	0	0	0	0	0	0	0	0	0
20 - 24.....	492	490	2	0	0	0	0	0	0	0	0
25 - 29.....	775	730	45	0	0	0	0	0	0	0	0
30 - 34.....	500	463	37	0	0	0	0	0	0	0	0
35 - 39.....	368	337	31	0	0	0	0	0	0	0	0
40 - 44.....	277	250	27	0	0	0	0	0	0	0	0
45 - 49.....	240	213	27	0	0	0	0	0	0	0	0
50 - 54.....	217	195	22	0	0	0	0	0	0	0	0
55 - 59.....	176	149	27	0	0	0	0	0	0	0	0
60 - 64.....	113	92	21	0	0	0	0	0	0	0	0
65 - 69.....	20	16	4	0	0	0	0	0	0	0	0
70 and over.....	7	7	0	0	0	0	0	0	0	0	0

University of Missouri

Table 3A
Salary Distributions
Level One
Academic and Administrative Employees
and Clerical and Service Employees
in Active Service on October 1, 2018

Annual salary	Academic and Administrative		Clerical and Service	
	Number	Percent	Number	Percent
Under \$20,000	1	0.0%	15	0.5%
\$20,000 - 24,999	0	0.0	61	2.0
25,000 - 29,999	8	0.1	426	14.3
30,000 - 34,999	55	0.8	632	21.2
35,000 - 39,999	165	2.5	574	19.2
40,000 - 44,999	275	4.2	405	13.6
45,000 - 49,999	440	6.8	358	12.0
50,000 - 54,999	567	8.8	257	8.6
55,000 - 59,999	489	7.5	114	3.8
60,000 - 64,999	521	8.0	49	1.6
65,000 - 69,999	491	7.6	43	1.4
70,000 - 74,999	425	6.6	19	0.6
75,000 - 79,999	426	6.6	21	0.7
80,000 - 84,999	315	4.9	9	0.3
85,000 - 89,999	279	4.3	3	0.1
90,000 - 94,999	220	3.4	1	0.0
95,000 - 99,999	210	3.2	0	0.0
100,000 - 104,999	174	2.7	0	0.0
105,000 - 109,999	138	2.1	0	0.0
110,000 - 114,999	129	2.0	0	0.0
115,000 - 119,999	108	1.7	1	0.0
120,000 - 124,999	75	1.2	0	0.0
125,000 - 129,999	86	1.3	0	0.0
130,000 - 134,999	63	1.0	0	0.0
135,000 - 139,999	69	1.1	0	0.0
140,000 - 144,999	61	0.9	0	0.0
145,000 - 149,999	49	0.8	0	0.0
150,000 and over	641	9.9	0	0.0
Total	6,480	100.0	2,988	100.0

Note: Detailed figures may not add to totals shown due to rounding.

University of Missouri

Table 3B
Salary Distributions
Level Two
Academic and Administrative Employees
and Clerical and Service Employees
in Active Service on October 1, 2018

Annual salary	Academic and Administrative		Clerical and Service	
	Number	Percent	Number	Percent
Under \$20,000	7	0.1%	68	2.1%
\$20,000 - 24,999	12	0.2	370	11.5
25,000 - 29,999	97	1.8	1,013	31.5
30,000 - 34,999	148	2.7	711	22.1
35,000 - 39,999	500	9.2	463	14.4
40,000 - 44,999	661	12.2	301	9.4
45,000 - 49,999	913	16.8	114	3.5
50,000 - 54,999	568	10.5	82	2.6
55,000 - 59,999	352	6.5	53	1.6
60,000 - 64,999	334	6.2	21	0.7
65,000 - 69,999	252	4.7	10	0.3
70,000 - 74,999	172	3.2	5	0.2
75,000 - 79,999	168	3.1	2	0.1
80,000 - 84,999	139	2.6	0	0.0
85,000 - 89,999	136	2.5	1	0.0
90,000 - 94,999	118	2.2	0	0.0
95,000 - 99,999	71	1.3	0	0.0
100,000 - 104,999	65	1.2	0	0.0
105,000 - 109,999	57	1.1	0	0.0
110,000 - 114,999	34	0.6	1	0.0
115,000 - 119,999	33	0.6	0	0.0
120,000 - 124,999	28	0.5	0	0.0
125,000 - 129,999	35	0.6	0	0.0
130,000 - 134,999	19	0.4	0	0.0
135,000 - 139,999	12	0.2	0	0.0
140,000 - 144,999	29	0.5	0	0.0
145,000 - 149,999	46	0.5	0	0.0
150,000 and over	433	8.0	0	0.0
Total	5,419	100.0	3,215	100.0

Note: Detailed figures may not add to totals shown due to rounding.

University of Missouri

Table 4

**Pensions in Force on October 1, 2018
By Monthly Amount**

Monthly amount	Total	Academic and Administrative	Clerical and Service
Less than \$100.....	69	21	48
\$100 - 199.....	309	132	177
200 - 299.....	457	168	289
300 - 399.....	454	170	284
400 - 499.....	520	226	294
500 - 599.....	490	193	297
600 - 699.....	433	192	241
700 - 799.....	399	194	205
800 - 899.....	403	214	189
900 - 999.....	368	188	180
1,000 - 1,199.....	697	382	315
1,200 - 1,399.....	560	301	259
1,400 - 1,599.....	452	277	175
1,600 - 1,799.....	442	309	133
1,800 - 1,999.....	344	223	121
2,000 - 2,199.....	315	225	90
2,200 - 2,399.....	267	205	62
2,400 - 2,599.....	219	176	43
2,600 - 2,799.....	218	188	30
2,800 - 2,999.....	213	174	39
3,000 - 3,399.....	350	314	36
3,400 - 3,799.....	273	262	11
3,800 - 4,199.....	225	216	9
4,200 - 4,599.....	179	176	3
4,600 - 4,999.....	115	113	2
5,000 and over.....	584	576	8
Total	9,355	5,815	3,540

Notes: Excludes beneficiaries of deceased retirees.

Monthly amount reflects reduction (net) for those individuals who elect to receive partial (e.g., 30%) lump-sum payment.

University of Missouri

Table 5

**Pensions in Force on October 1, 2018
by Age**

Age on October 1, 2018	Total	Academic and Administrative	Clerical and Service
55 - 59.....	307	150	157
60 - 64.....	1,087	573	514
65 - 69.....	2,460	1,477	983
70 - 74.....	2,122	1,368	754
75 - 79.....	1,540	1,012	528
80 - 84.....	950	626	324
85 - 89.....	561	385	176
90 - 94.....	241	161	80
95 - 99.....	78	55	23
100 and over.....	9	8	1
Total	9,355	5,815	3,540

Note: Excludes beneficiaries of deceased retirees.

University of Missouri

Table 6

**Pensions Awarded in the Year Ended September 30, 2018
by Monthly Amount**

Monthly amount	Total	Academic and Administrative	Clerical and Service
Less than \$100.....	2	1	1
\$100 - 199.....	20	10	10
200 - 299.....	18	9	9
300 - 399.....	22	7	15
400 - 499.....	53	15	38
500 - 599.....	43	16	27
600 - 699.....	32	15	17
700 - 799.....	36	16	20
800 - 899.....	39	19	20
900 - 999.....	43	22	21
1,000 - 1,199.....	66	37	29
1,200 - 1,399.....	64	36	28
1,400 - 1,599.....	49	28	21
1,600 - 1,799.....	53	31	22
1,800 - 1,999.....	44	25	19
2,000 - 2,199.....	31	22	9
2,200 - 2,399.....	30	22	8
2,400 - 2,599.....	23	17	6
2,600 - 2,799.....	23	15	8
2,800 - 2,999.....	28	18	10
3,000 - 3,399.....	39	35	4
3,400 - 3,799.....	20	17	3
3,800 - 4,199.....	20	20	0
4,200 - 4,599.....	15	15	0
4,600 - 4,999.....	13	12	1
5,000 and over.....	58	56	2
Total	884	536	348

Note: Monthly amount reflects reduction (net) for those individuals who elected to receive partial (e.g., 30%) lump-sum payment.

University of Missouri

Table 7

**Pensions Awarded in the Year Ended September 30, 2018
by Age**

Age on Effective Date	Total	Academic and Administrative	Clerical and Service
55 - 59	185	90	95
60 - 64	321	179	142
65 - 69	304	212	92
70 - 74	56	41	15
75 - 79	17	13	4
80 & over	1	1	0
Total	884	536	348
Average age at retirement	63.6	64.2	62.6

University of Missouri

Table 8

**Development of Actuarial Value of Assets
As of September 30, 2018**

1. Market value of assets, September 30, 2018			\$3,684,544,817
2. Calculation of Unrecognized Return *	<u>Original Amount</u>	<u>Unrecognized Return</u>	
(a) Year ended September 30, 2018	\$(15,015,791)	\$(12,012,633)	
(b) Year ended September 30, 2017	119,947,402	71,968,441	
(c) Year ended September 30, 2016	43,926,675	17,570,670	
(d) Year ended September 30, 2015	(308,266,343)	(61,653,269)	
(e) Year ended September 30, 2014	4,583,904	<u>0</u>	
(f) Total Unrecognized Return			15,873,209
3. Preliminary actuarial value: (1) – (2f)			\$3,668,671,608
4. Adjustment to be within 20% corridor			0
5. Final actuarial value of assets as of September 30, 2018: (3) + (4)			\$3,668,671,608
6. Actuarial value as a percentage of market value: (5)/(1)			99.6%

* Total return minus expected return on a market value basis.

University of Missouri

Table 9

**Statement of Income and Disbursements
Market Value and Actuarial Value Reconciliation for Year Ended September 30, 2018**

	Market Value	Actuarial Value
<u>Income</u>		
Employer contributions	\$97,231,969	\$97,231,969
Employee contributions.....	15,374,474	15,374,474
Investments:		
Income	63,486,515	N/A
Net gain / (loss) from sales of investments.....	235,610,613	N/A
Unrealized appreciation (depreciation)	(38,871,452)	N/A
Actuarial value recognition	<u>N/A</u>	
Total investment income gain	260,225,676	221,717,484
Total income	\$372,832,119	\$334,323,927
<u>Disbursements</u>		
Total benefit payments	\$(237,803,044)	\$(237,803,044)
Expenses.....	<u>(22,559,152)</u>	<u>N/A</u>
Total disbursements.....	(260,362,196)	(237,803,044)
Excess (shortfall) of income over disbursements.....	112,469,923	96,520,883
Fund balance, September 30, 2017.....	3,572,074,894	3,572,150,725
Adjustment*	<u>N/A</u>	<u>0</u>
Fund balance value, September 30, 2018.....	\$3,684,544,817	\$3,668,671,608
Net returns **	6.77%	6.32%

* Actuarial value of assets shall not be less than 80% nor greater than 120% of market value.

** Calculated by formula $2I/(A + B - I)$ where I is investment earnings minus expenses, A is fund balance at beginning of period and B is fund balance at end of period. Information is reported on Retirement Fund History. The net actuarial return reflects the adjustment to be within 120% of market value.

University of Missouri

Table 10
Determination of the
Unfunded Actuarial Accrued Liability
October 1, 2018

	Academic and Administrative	Clerical and Service	Total
Actuarial Accrued Liability Components:			
Active members	\$1,691,496,261	\$364,038,595	\$2,055,534,856
Inactive vested members	223,082,251	50,236,344	273,318,595
Retirees and beneficiaries	<u>1,703,857,398</u>	<u>434,207,801</u>	<u>2,138,065,199</u>
Total Actuarial Accrued Liability			\$4,466,918,650
Actuarial Value of Assets			\$3,668,671,608
Total Unfunded Actuarial Accrued Liability.....			\$798,247,042

University of Missouri

Table 11

**Total Unfunded (Overfunded)
Actuarial Accrued Liability
Ten Year History**

October 1:	Dollar Amount	Percent of Payroll
2009	\$(23,897,581)	(2.5)%
2010	108,874,773	11.1
2011	309,493,199	30.0
2012	518,344,622	49.6
2013	512,470,418	47.5
2014	476,427,007	42.9
2015	474,031,119	42.0
2016	459,286,212	40.1
2017	738,711,563	64.4
2018	798,247,042	67.2

Note: Based on actuarial value of assets.

University of Missouri

Table 12
Percent Funded
Ratio of Assets to
Total Actuarial Accrued Liability

October 1:	Market Value of Assets	Actuarial Value of Assets
2009	84.0%	100.8%
2010	85.1	96.3
2011	79.8	90.1
2012	84.3	84.3
2013	88.1	85.2
2014	89.2	86.9
2015	82.6	87.4
2016	84.9	88.2
2017	82.9	82.9
2018	82.5	82.1

University of Missouri

Table 13

**Actuarially Determined Contribution Rates
for the Past Five Years**

	For Plan Year Beginning October 1									
	2014		2015		2016		2017		2018	
	Level One	Level Two	Level One	Level Two	Level One	Level Two	Level One	Level Two	Level One	Level Two
Normal cost percentage	7.28%	3.26%	7.26%	3.24%	7.26%	3.24%	7.12%	3.32%	7.07%	3.32%
Amortization percentage*	3.63	3.63	3.59	3.59	3.47	3.47	5.37	5.37	5.69	5.69
Total contribution rate	10.91	6.89	10.85	6.83	10.72	6.71	12.50	8.69	12.76	9.01
Employee contribution rate	1.30	1.21	1.32	1.21	1.33	1.23	1.34	1.23	1.36	1.25
Net contribution rate	9.61	5.68	9.53	5.61	9.39	5.48	11.16	7.46	11.40	7.76

* 30-year closed amortization schedule effective October 1, 2013.

Note: Detailed figures may not add due to rounding.

Blended Level One and Level Two Contribution Rates**

<u>October 1</u>	<u>Net Contribution Rate**</u>
2014	8.97%
2015	8.59%
2016	8.20%
2017	9.83%
2018	9.87%

** Does not include contributions to the defined contribution plan for Level Two employees.

III. SUMMARY OF PRINCIPAL PLAN PROVISIONS

The 2018 actuarial valuation is based on the present provisions of the Plan, which are summarized in this Section. The information included in this section is not to be considered a substitute for the plan itself. It is merely a summary of the principal provisions of the plan included in the actuarial valuation.

EFFECTIVE DATE: Adopted June 15, 1956. The plan was amended, restated and recodified as of December 8, 1989 to be effective September 1, 1990. Employees who terminated employment prior to December 8, 1989 are covered under the provisions of the plan in effect prior to that date which shall heretofore be referred to as the Prior Plan. Employees who terminated employment on or after August 31, 1990 are covered under the provisions of the plan in effect subsequent to that date which shall heretofore be referred to as the Revised Plan. Employees who terminate employment on or after December 8, 1989 and prior to September 1, 1990 may elect to continue under the provisions of the prior Plan or effective September 1, 1990 to have their benefits adjusted to the Revised Plan basis. Subsequently, the Plan has had provisions of the Revised Plan amended from time to time.

MEMBER: Level One Member is one who was initially hired prior to October 1, 2012. Level Two Member is one who is hired or rehired on or after October 1, 2012 (except that a Qualified Member who was initially hired prior to October 1, 2012, earned a vested benefit, terminated service after earning such vested benefit, did not receive a lump sum payment, and is rehired by the University on or after October 1, 2012 shall be a Level One Member).

ELIGIBILITY: All full-time academic, administrative and other employees (except for those explicitly excluded by the terms of the plan) of the University paid from its public funds are eligible for benefits after five years of credited service.

COMPENSATION BASE: It is the average regular annual salary, excluding any incentive compensation and including any shift differential pay, of the member for the five consecutive highest salary years of employment. Salary year is September 1 through August 31.

CREDITED SERVICE: Credited service is the number of continuous years and fractional parts thereof between date of employment and termination. A full year's credit shall be granted for twelve months of service with proportional credit for shorter periods of service. Special provisions are made for members on nine-month appointments.

For part-time employees on non-academic appointments:

- a. On and after September 1, 1957, one (1) year of Service Credit shall be awarded to a Member on part-time service who is required to complete at least one thousand five hundred (1,500) hours of service in a Contract Year.
- b. In the case of a Member who completes less than a full Contract Year as a result of commencement or termination of employment, proportionate credit shall be given for such Contract Year provided such Member has completed at least one thousand five hundred (1,500) hours of Service during such Contract Year.
- c. Except as provided in subparagraphs (a) and (b), no Service Credit shall be awarded for part-time employment.

LEAVE OF ABSENCE: Periods of leaves of absence do not constitute service credit or an interruption of such service unless otherwise specified. Periods of leaves of absence on account of military service and sick leave without pay constitute service credit. Seasonal leaves (not to exceed three months per contract year), shall be taken into account as service credit only if the member returns to active full-time employment at the University immediately following the seasonal leave. Sabbatical, research and development leaves constitute service credit only if a full year of service is rendered in the next contract year immediately following such leave. Accumulated unused sick leave counts as credited service.

RATES OF REGULAR PENSION: The annual lifetime pension is calculated by multiplying the total number of years of service credit by 2.2% for Level One Member or 1.0% for Level Two Member of his or her compensation base.

PENSION CREDIT FOR SUMMER EMPLOYMENT: Academic members on a nine-month appointment basis who render summer service shall receive additional pension credit for such service. The additional pension is calculated to be 2.2% for Level One Member or 1.0% for Level Two Member of average regular summer appointment salary multiplied by the total number of summer appointments and is added to the regular pension. Average regular summer appointment salary is the average of the summer salaries earned during the 5 consecutive highest summers worked. Summer salary may not exceed 3/9 of regular compensation (2/9 of regular compensation prior to May 1, 2011).

MINIMUM VALUE ACCUMULATION: Level One Members shall receive a minimum benefit based on the actuarial equivalence of an account crediting 5% of each year's pay accumulated at 7½% interest annually. No minimum benefit is applicable for Level Two Members.

CONDITIONS FOR GRANT OF PENSION:

- (1) Normal Retirement, at member's option, at age 65 or thereafter.
- (2) Early Retirement, at member's option, after age 60 with five years of credited service. If the member has at least 10 years of credited service at retirement, with one year of credit after attaining age 54, the member may retire any time after age 55. The reduction is at the rate of 3-1/3% for each year that the member's age precedes age 65. If the member has at least 25 years of credited service, the reduction rate is 0% from age 65 to age 62 and 3-1/3% for each year thereafter to age 55. Terminated vested employees are not eligible for these early retirement reduction factors.
- (3) Retirement for total and permanent disability at any time. The Qualified member applies for continued participation in the plan as a disabled member. Upon subsequent Normal or Early Retirement, the member's pension is calculated under the Revised Plan based upon base compensation at the commencement of total

and permanent disability and the years of service that the member would have earned if he or she had remained in employment until actual retirement.

- (4) Severance after completion of at least five years of credited service. The pension, payable when and if the ex-employee reaches age 65, is based on the accrued credits at date of severance. Said pension may be paid in a reduced amount after attainment of age 55. The reduction is at the rate of 6-2/3% for each of the first five years that the member's age precedes age 65 and 3-1/3% for each of the next five years.

DEATH BENEFITS: The beneficiary of a member dying in active employment with five or more years of credited service shall receive the greater of two times for a Level One Member or one times for Level Two Member the employee's base salary at the time of death (but not in excess of 100 times the monthly retirement benefit the employee would have received at normal retirement date based on service to such date and total base compensation at the time of death) or the actuarial present value of the benefit the employee would have received if the employee had retired on the day before death (but not less than the minimum value accumulation for Level One Members).

The beneficiary of a terminated vested member dying prior to commencement of benefits shall receive the lump sum that the member was eligible to elect to receive at the time of his or her termination of employment, increased with interest from date of termination to date of death.

OPTIONAL BENEFITS: The employee may be eligible to elect to receive a reduced pension in exchange for one or more of several optional forms or combinations of optional forms of annuity, *e.g.*, 2% automatic annual increases in such reduced pension; 50%, 75% or 100% joint and survivor annuity with pop-up; or 120-month period certain and life annuity.

LUMP SUM PAYMENTS: An employee who terminates employment prior to eligibility for a normal or early retirement pension may elect:

- (1) to have 100% of the actuarial equivalent value of his or her benefit paid in a direct rollover to the trustee of an Individual Retirement Account (IRA) or the trustee of another employer's qualified plan that accepts such rollovers; or
- (2) to receive the value of his or her benefit in cash as a lump sum payment.

An employee who terminates employment and is eligible to commence his or her early or normal retirement benefit may elect to have 10%, 20% or 30% of the actuarial equivalent value of the benefit paid either in a lump sum or in a direct rollover payment to the trustee of an Individual Retirement Account (IRA) or the trustee of another employer's qualified plan that accepts such rollovers. If such an election is made, the balance of his or her benefit (100% minus the percentage elected to be paid in a lump sum or direct rollover) will be paid under any of the payment options discussed above.

FINANCING OF PLAN: The University will make contributions to a trust fund under the advice of its actuary. All plan benefits shall be paid from this fund.

TERMINATION OF PLAN: The plan may be terminated by the University at any time and without any liability to make further contributions. The trust fund will then be used to continue benefits with the following order of priorities:

- (i) Pensioners in course of payment and pensions payable to employees age 65 and over.
- (ii) Pensions deferred to age 65 for employees age 60 with 20 years of service, and for ex-employees with vested rights to deferred pensions who were employed at or after age thirty-five.
- (iii) Other employees in proportion to the value of their accrued pensions.

EMPLOYEE CONTRIBUTIONS: Effective July 1, 2009, members are required to contribute 1% of their salary up to \$50,000 plus 2% of their salary in excess of \$50,000. Contribution account balances are refunded with interest at 4% per year if the member terminates prior to becoming a Qualified Member. If the member terminates due to death prior to becoming a Qualified Member, the refund of the account balance is paid to the member's beneficiary.

IV. ACTUARIAL ASSUMPTIONS AND METHODS

The actuarial assumptions and cost methods used in this 2018 actuarial valuation are the same as those used in last year's valuation.

The assumptions and methods used in this valuation are based on the results of the Actuarial Experience Study for 2012-2016 and were approved by the Board of Curators. Current data was reviewed in conjunction with this valuation. Based on professional judgment, no assumption or method changes are warranted at this time.

Investment Return

Funding a retirement system on an actuarial reserve basis involves the accumulation of substantial reserves to pay benefits in the future. These reserves are invested and the rate of investment return is a major factor in determining the contributions required to support the ultimate cost of benefits.

For this 2018 actuarial valuation, the net long-term rate of investment return - after expenses - is assumed to be 7.20% per year.

During the fiscal year ended September 30, 2018, the total rate of return on an actuarial value basis was approximately 6.32%. The schedule that follows shows the total rate of investment return for each of the past ten fiscal years.

Fiscal Year Ended September 30:	Total Rate of Return (Actuarial Value of Assets)
2009	3.65%*
2010	2.77
2011	1.35
2012	0.61
2013	7.46
2014	8.80
2015	6.51
2016	7.14
2017	7.15
2018	6.32

* Reflects the adjustment for actuarial value of assets to be within 120% of market value.

Salary and Payroll Increases

Because the benefits provided by the Plan are based on an employee's final average compensation, increases in salaries have a significant effect on the Plan's ultimate cost.

For this 2018 actuarial valuation, total salary increases are projected by an age-related salary scale. The age-related salary scale is intended to project salary increases attributable to all "factors" (*i.e.*, increases due to inflation, promotions, service longevity, etc.).

The salary increases exclusive of the inflation component assumed for this 2018 actuarial valuation are shown below for selected ages:

Age	Assumed Salary Increase Rates	
	Academic and Administrative	Clerical and Service
25	6.0%	3.0%
30	3.5	2.4
35	2.5	1.9
40	2.1	1.4
45	1.7	0.9
50	1.3	0.6
55	0.6	0.5
60	0.1	0.1

The assumed inflation component of the salary increases is 2.2% at all ages.

Retirement Rates

The assumed rates of retirement project the percentage of eligible employees who will retire at each age. The assumed retirement rates used in the 2018 actuarial valuation for selected ages are shown below:

Academic and Administrative		
Attained Ages	Under 25 Years of Service	Over 25 Years of Service
55	4%	6%
56-59	3	4
60-61	5	7
62	10	20
63-64	10	12
65	20	20
66	20	20
67-69	15	15
70-71	20	20
72-79	20	20
80	100	100

Clerical and Service		
Attained Age	Under 25 Years of Service	Over 25 Years of Service
55	7%	9%
56-59	5	6
60-61	10	12
62	20	35
63-64	14	19
65	35	35
66	35	35
67-69	25	25
70-71	25	25
72-79	25	25
80	100	100

Withdrawal Rates

The assumed withdrawal or turnover rates used in the 2018 actuarial valuation are shown below for selected years of service:

Years of Service	Withdrawal Rates	
	Academic and Administrative	Clerical and Service
0	21.5%	31.0%
1	21.0	23.0
2	18.5	19.5
4	13.0	13.5
6	12.0	11.5
8	9.0	10.0
10	7.5	8.5
12	6.0	7.0
14	5.0	6.0
16	4.5	4.5
18	4.0	4.0

Note: Withdrawal rates cut out at first eligibility for an immediate pension.

Disability Rates

The assumed rates of disablement used in the 2018 valuation are shown below for selected ages:

Age	Disability Rates
40	0.05%
45	0.13
50	0.24
55	0.46
60	0.76

Mortality Rates

A mortality table is used to project the number of employees at each age who will die in active service, and also to determine the amount of the reserve required at the time of retirement to pay benefits for the remainder of an employee's lifetime.

The mortality table used in the 2018 actuarial valuation to project mortality rates for all healthy annuitants is the RP-2014 Healthy Annuitant Mortality Table projected on a generational basis in

accordance with the MP-2017 mortality improvement scale published by the Society of Actuaries. For healthy non-annuitants, the mortality table used is the RP-2014 Employee Mortality Table projected on a generational basis in accordance with the MP-2017 mortality improvement scale. For disabled members, the mortality table used is the RP-2014 Disabled Annuitant Mortality Table projected on a generational basis using Scale MP-2017. These mortality tables projected to 2018 reasonably reflect the projected mortality experience as of the measurement date. The schedule below shows the assumed mortality rates and projected life expectancies as of the valuation date for non-disabled retired members for selected ages:

Age	Mortality Rates		Expected Years of Life Remaining	
	Male	Female	Male	Female
60	0.78%	0.53%	25.7	28.0
70	1.64	1.24	17.3	19.1
80	4.31	3.39	10.1	11.4
90	13.21	10.51	5.0	5.8

Presence and Age of Spouse

The assumption made with respect to the proportion of married employees is 80%. It is also assumed for purposes of the actuarial valuation that female spouses are on the average three years younger than male spouses.

Asset Valuation Method

The asset valuation method used is the Expected Return Asset Valuation Method. Assets for actuarial valuation purposes are valued as the market value of assets less unrecognized returns in each of the last five years. Unrecognized return is equal to the difference between the actual market return and the expected return on the market value, and is recognized over a five-year period. The actuarial value is further adjusted, if necessary, to be within 20% of the market value.

Actuarial Funding Method

Funding the Plan on an actuarial reserve basis seeks to achieve the following major objectives:

- Level required contribution rates as a percentage of payroll over a long period of years;
- Finance benefits earned by present employees on a current basis;
- Accumulate assets to enhance members' benefit security;
- Produce investment earnings on accumulated assets to help meet future benefit costs;
- Make it possible to estimate the long-term actuarial cost of proposed amendments to Plan provisions; and
- Maintain the Plan's long-term financial viability.

The basic funding objective is a level pattern of cost as a percentage of salary throughout an employee's working lifetime. The funding method used in this actuarial valuation - the entry age normal cost method - is intended to meet this objective and result in a relatively level long-term contribution requirement as a percentage of salary.

V. ACCOUNTING INFORMATION

The Governmental Accounting Standards Board (GASB) determines the way governmental entities account for their pension plans. The prior standards were GASB Statements Nos. 25 and 27.

GASB has issued new accounting and financial reporting standards. GASB Statement No. 67, *Financial Reporting for Pension Plans*, which applies to pension plans established as trusts or similar arrangements, has replaced GASB No. 25 for fiscal years beginning after June 15, 2013. GASB Statement No. 68, *Accounting and Financial Reporting for Pensions by State and Local Governmental Employers*, which applies to government employers that sponsor or contribute to state or local pensions, has replaced GASB Statement No. 27 for those fiscal years beginning after June 15, 2014. The University elected to first apply GASB Statement No. 68 for its fiscal year July 1, 2013 – June 30, 2014.

The required disclosures under GASB Statement Nos. 67 and 68 are provided in a separate report. However, the liabilities to be reported under GASB Statement Nos 67 and 68 as of June 30, 2018 are based on the participant data reflected in this valuation. The pension expense for certain changes in liability is the amount of the change amortized over the average expected remaining service lives of all plan participants. Based upon this valuation, this average period is 5.402 years.

VI. ACTUARIAL VALUATION STATEMENT

This is to certify that we have prepared an actuarial valuation of the University of Missouri Retirement, Disability and Death Benefit Plan as of October 1, 2018.


Actuarial calculations were made with respect to 18,102 covered active members, 4,817 inactive members with vested benefit rights, and 10,316 pensioners and beneficiaries.

The actuarial cost factors as of the valuation date are as follows:

Total Normal Cost.....	\$65,243,875
Total Actuarial Accrued Liability	4,466,918,650
Assets at Actuarial Value.....	3,668,671,608
Total Unfunded Actuarial Accrued Liability	798,247,042
Payment to amortize unfunded actuarial accrued liability over 25 years	67,535,898
Total payroll.....	1,187,434,514
Total Contribution Requirement	
Dollar	\$132,779,773
Percent of payroll.....	11.18%
Expected Employee Contribution	
Dollar	\$15,595,741
Percent of payroll.....	1.31%
Total Net Contribution Requirement	
Dollar	\$117,184,032
Percent of payroll.....	9.87%

The actuarial calculations were performed by qualified actuaries in accordance with generally accepted actuarial procedures, based on the current provisions of the University of Missouri Retirement, Disability and Death Benefit Plan and on the actuarial assumptions and methods adopted by the Board. The assumptions used in the October 1, 2018 actuarial valuation are reasonably related to the past and anticipated future experience of the Plan.

The Plan is funded on an actuarial reserve basis.


 Joshua Kaplan, FSA, FCA, MAAA, EA
 Vice President and Actuary

8868050v1/03731.001