



University of Missouri System

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

**Actuarial Valuation as of October 1, 2017**

**Copyright © 2018  
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 16, 2018

Board of Curators  
University of Missouri  
Columbia, MO 65211

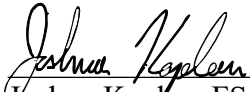
Dear Curators:

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, 2017. Our actuarial valuation is based on the current actuarial assumptions and provisions of the Plan, membership and financial data as of October 1, 2017.

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 2017 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 .....	8
Changes in Plan Provisions Since Previous Year .....	8
Changes in Plan Contribution Requirements Since Previous Year .....	9
Changes in Unfunded Actuarial Liabilities Since Previous Year .....	9
II. PARTICIPANT AND PLAN STATISTICAL INFORMATION .....	10
III. SUMMARY OF PRINCIPAL PLAN PROVISIONS .....	30
IV. ACTUARIAL ASSUMPTIONS AND METHODS.....	36
V. ACCOUNTING INFORMATION .....	42
VI. ACTUARIAL VALUATION STATEMENT .....	43

## 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, 2017 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, 2017 amounted to \$3,572,150,725.

The actuarial valuation report as of October 1, 2017 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 7,538 active employees as of the valuation date (October 1, 2017) who are impacted by these plan benefit changes. The October 1, 2017 valuation determines the contribution requirements for the University's fiscal year July 1, 2018 – June 30, 2019. 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 22,794 active and inactive members of the University are included in this 2017 actuarial valuation. Approximately 65.0% of the active members are academic and administrative employees and 35.0% are clerical and service employees.

	<b>Academic and Administrative</b>	<b>Clerical and Service</b>	<b>Total Employees</b>
Active members	11,777	6,358	18,135
Inactive members	<u>3,261</u>	<u>1,398</u>	<u>4,659</u>
Total active and inactive members	15,038	7,756	22,794

The average annual salaries of academic and administrative employees increased by 0.5% to \$78,361 and clerical and service employees decreased by 0.2% to \$35,229. Note that these figures reflect that a net of 175 employees were reclassified from clerical and service to academic and administrative. For the total actives, average salary was up 0.8% from the prior year.

The number and payrolls of active members are shown below:

	<b>Academic and Administrative</b>		<b>Clerical and Service</b>		<b>Total</b>	
	<b>Number</b>	<b>Payroll</b>	<b>Number</b>	<b>Payroll</b>	<b>Number</b>	<b>Payroll</b>
Level One	7,063	\$597,974,469	3,534	\$135,314,992	10,597	\$733,289,461
Level Two	4,714	<u>324,878,395</u>	<u>2,824</u>	<u>88,668,105</u>	<u>7,538</u>	<u>413,546,500</u>
Total	11,777	\$922,852,864	6,358	\$223,983,097	18,135	\$1,146,835,961

**Retired Members and Beneficiaries**

**(Tables 4 through 7 - Section II)**

There were 751 retirements during the year ending September 30, 2017.

On October 1, 2017, the Plan was paying benefits to a total of 9,763 members (including 8,749 pensioners and 1,014 beneficiaries and survivors). The total number of benefit recipients increased 5.6% from 9,242 on October 1, 2016. The 8,749 pensioners were comprised of 5,438

academic and administrative and 3,311 clerical and service. Additionally, 23 former spouses were in payment status as of the valuation date.

As of October 1, 2017, the average annual benefit payable to retirees was \$27,854 for academic and administrative and \$11,184 for clerical and service, compared to \$27,312 and \$10,678, respectively, as of October 1, 2016. The average annual benefit payable to beneficiaries was \$15,155 as of October 1, 2017, compared to \$14,527 as of October 1, 2016. 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, 2017, net assets totalled \$3,572,074,894 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, 2017 is \$3,572,150,725 and is 100.0% 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, 2017 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**

	<b>Academic and Administrative</b>	<b>Clerical and Service</b>	<b>Total</b>
Normal Cost - Dollar	\$43,464,242	\$8,780,810	\$52,245,052
Normal Cost - % of payroll	7.27%	6.49%	7.12%

**Actuarially Determined Normal Costs for Level Two Employees**

	<b>Academic and Administrative</b>	<b>Clerical and Service</b>	<b>Total</b>
Normal Cost - Dollar	\$11,152,828	\$2,581,378	\$13,734,206
Normal Cost - % of payroll	3.43%	2.91%	3.32%

**Actuarial Accrued Liability**

The total actuarial accrued liability represents the amount that would have been accumulated as of October 1, 2017 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, 2017, the actuarial value of assets of the Plan (\$3,572,150,725) fell short of the actuarial accrued liability (\$4,310,862,288) by \$738,711,563. The unfunded actuarial liability is

being recognized for funding purposes assuming it is to be amortized over a period of 26 years from the October 1, 2017 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 \$61,615,901 representing 5.37% of total payroll for all employees. As shown on the following page, this compares to \$39,677,403 (3.47% of payroll) as of October 1, 2016. This increase is primarily due to the change in actuarial assumptions. Employee contributions as a percentage of payroll for Level One and Level Two are projected to be 1.34% and 1.23%, respectively. Therefore, the net employer cost is 11.16% for Level One employees and 7.46% 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. In this connection, because the market value of the Plan's assets as of October 1, 2017, \$3,572,074,894, was less than the present value of the Plan's accrued benefits, \$3,646,906,149, the Plan's frozen liabilities were 97.9% 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 the \$3,646,906,149 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, 2017	As of October 1, 2016
<b>Membership</b>		
1. Active members	18,135	18,233
2. Inactive vested members	4,659	4,215
3. Pensioners and beneficiaries	<u>9,763</u>	<u>9,242</u>
4. Total membership	32,557	31,690
5. Compensation of active members	\$1,146,835,961	\$1,144,411,843

Contribution Requirements	As of October 1, 2017			As of October 1, 2016		
	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	\$65,979,258	7.12%	3.32%	\$68,987,885	7.26%	3.24%
2. Total costs (including amortization of unfunded liability):						
(a) 26-year funding*	127,595,159	12.50%	8.69%	108,665,288	10.72%	6.71%
(b) 20-year funding	134,561,177	13.10%	9.30%	113,345,890	11.13%	7.12%
(c) 10-year funding	168,779,741	16.09%	12.28%	134,737,950	12.97%	8.96%
3. Expected employee contribution	14,908,183	1.34%	1.23%	14,858,830	1.33%	1.23%
4. Net employer contribution (26-year* funding)	\$112,686,976	11.16%	7.46%	\$93,806,458	9.39%	5.48%

\* 27-year funding as of October 1, 2016

### Analysis of Actuarial Experience

**Investment Experience.** During the year ending September 30, 2017, the total actuarial rate of investment return on the prior actuarial value was 7.15%, or 0.60% lower than the prior assumed long-term rate of 7.75% per year. As a result of this investment experience, an actuarial loss of \$20.3 million was incurred. In turn, the amortization percentages as of October 1, 2017 were higher than they would have been if the investment returns rate had equalled the assumed rate.

For example, under the University's 26-year amortization policy, the resulting annual cost increase as a result of the investment experience was \$1,771,509, or 0.15% of payroll.

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 \$112,686,976 would have increased by \$29,795,294 to \$142,482,270.

**Demographic Changes.** The aggregate employer normal cost rate between the 2016 and 2017 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, 2017, 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 2016 and 2017 actuarial valuations, the average salary increased by 0.5% for academic and administrative employees and decreased by 0.2% 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 2.5% and the average salary of previously active clerical and service employees increased 1.4%. These actual salary increase patterns were less than the assumed increases producing an actuarial gain of \$28.4 million. This translated to a 0.21% of payroll cost decrease under the 26-year amortization policy.

### **Changes in Actuarial Assumptions Since Previous Year**

Based on the most recent quinquennial study of the University's own experience for 2012-2016, the following actuarial assumptions were revised in this 2017 actuarial valuation:

- Mortality for healthy and disabled lives
- Salary and payroll increases, including the assumed rate of inflation
- Rates of retirement for active employees
- Withdrawal (or turnover) rates
- Investment return

The actuarial cost methods used in this 2017 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**

	<b><u>Dollar Amounts</u></b>	<b><u>Percent of Payroll</u></b>
Total cost as of October 1, 2016	\$108,665,288	9.50%
Changes due to:		
Change due to increased payroll	146,132	(0.01)
Shift to Level Two plus other demographic changes	(2,899,646)	(0.25)
Loss/(gain) from actuarial experience and contributions	2,165,496	0.18
Changes in actuarial assumptions	<u>19,517,889</u>	<u>1.71</u>
Total change:	\$18,929,871	1.63%
Total cost as of October 1, 2017	\$127,595,159	11.13%*

\*The total costs for Level One and Level Two employees are 12.50% and 8.69% of payroll, respectively.

**Changes in Unfunded Actuarial Liabilities Since Previous Year**

Unfunded actuarial liabilities as of October 1, 2016	\$459,286,212
Changes due to:	
Loss (gain) from actuarial experience and contributions	
– Investment return:	\$20,261,756
– Salary increases:	(28,426,339)
– Other:	27,459,479
Subtotal	19,294,896
Changes in actuarial assumptions	<u>260,130,455</u>
Total change:	\$279,425,351
Unfunded actuarial liabilities as of October 1, 2017	\$738,711,563

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

**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:				
	2013	2014	2015	2016	2017
<b>ACADEMIC AND ADMINISTRATIVE</b>					
Number.....	10,093	9,325	8,418	7,672	7,063
Average age.....	47.5	48.5	49.2	50.1	50.6
Average years of service.....	11.5	12.7	13.5	14.5	15.5
Average annual salary* .....	\$76,425	\$78,940	\$81,384	\$83,412	\$84,663
Total payroll (millions).....	\$771.4	\$736.1	\$685.1	\$639.9	\$598.0
<b>CLERICAL AND SERVICE</b>					
Number.....	6,243	5,413	4,703	4,073	3,534
Average age.....	46.2	47.6	48.7	49.7	50.4
Average years of service.....	10.9	12.3	13.4	14.5	15.5
Average annual salary* .....	\$34,187	\$35,465	\$36,749	\$37,852	\$38,289
Total payroll (millions).....	\$213.4	\$192.0	\$172.8	\$154.2	\$135.3
<b>TOTAL EMPLOYEES</b>					
Number.....	16,336	14,738	13,121	11,745	10,597
Average age.....	47.0	48.2	49.0	50.0	50.6
Average years of service.....	11.3	12.5	13.4	14.5	15.5
Average annual salary* .....	\$60,283	\$62,972	\$65,385	\$67,612	\$69,198
Total payroll (millions).....	\$984.8	\$928.1	\$857.9	\$794.1	\$733.3

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:				
	2013	2014	2015	2016	2017
<b>ACADEMIC AND ADMINISTRATIVE</b>					
Number.....	1,220	2,271	3,281	4,068	4,714
Average age.....	36.2	36.8	37.1	37.6	37.9
Average years of service.....	0.4	0.9	1.3	1.6	2.0
Average annual salary* .....	\$58,779	\$61,966	\$64,225	\$67,645	\$68,918
Total payroll (millions) .....	\$71.7	\$140.7	\$210.7	\$275.2	\$324.9
<b>CLERICAL AND SERVICE</b>					
Number.....	779	1,398	2,043	2,420	2,824
Average age.....	34.0	34.5	34.7	35.1	35.6
Average years of service.....	0.4	0.9	1.2	1.6	1.9
Average annual salary* .....	\$28,049	\$29,055	\$29,929	\$31,043	\$31,398
Total payroll (millions) .....	\$21.9	\$40.6	\$61.1	\$75.1	\$88.7
<b>TOTAL EMPLOYEES</b>					
Number.....	1,999	3,669	5,324	6,488	7,538
Average age.....	35.3	36.0	36.2	36.7	37.1
Average years of service.....	0.4	0.9	1.2	1.6	2.0
Average annual salary* .....	\$46,804	\$49,426	\$51,064	\$53,993	\$54,862
Total payroll (millions) .....	\$93.6	\$181.3	\$271.9	\$350.3	\$413.5

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:				
	2013	2014	2015	2016	2017
<b>ACADEMIC AND ADMINISTRATIVE</b>					
Number .....	11,313	11,596	11,699	11,740	11,777
Average age .....	46.3	46.2	45.8	45.8	45.6
Average years of service .....	10.3	10.4	10.0	10.1	10.1
Average annual salary* .....	\$74,522	\$75,616	\$76,572	\$77,949	\$78,361
Total payroll (millions).....	\$843.1	\$876.8	\$895.8	\$915.1	\$922.9
<b>CLERICAL AND SERVICE</b>					
Number .....	7,022	6,811	6,746	6,493	6,358
Average age .....	44.9	45.0	44.5	44.3	43.8
Average years of service .....	9.8	9.9	9.7	9.7	9.5
Average annual salary* .....	\$33,506	\$34,149	\$34,683	\$35,314	\$35,229
Total payroll (millions).....	\$235.3	\$232.6	\$234.0	\$229.3	\$224.0
<b>TOTAL EMPLOYEES</b>					
Number .....	18,335	18,407	18,445	18,233	18,135
Average age .....	45.7	45.8	45.3	45.2	45.0
Average years of service .....	10.1	10.2	9.9	9.9	9.9
Average annual salary* .....	\$58,814	\$60,272	\$61,251	\$62,766	\$63,239
Total payroll (millions).....	\$1,078.3	\$1,109.4	\$1,129.8	\$1,144.4	\$1,146.8

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, 2017**

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.....	7,063	78	2,165	1,638	1,296	809	552	326	136	63
25 - 29.....	82	5	77	0	0	0	0	0	0	0
30 - 34.....	477	15	394	67	1	0	0	0	0	0
35 - 39.....	813	13	467	278	55	0	0	0	0	0
40 - 44.....	887	19	341	297	189	40	1	0	0	0
45 - 49.....	1,015	8	280	317	243	135	30	2	0	0
50 - 54.....	1,134	13	202	249	295	204	123	47	1	0
55 - 59.....	1,153	3	161	194	241	210	187	118	39	0
60 - 64.....	941	1	161	151	195	148	140	90	45	10
65 - 69.....	397	1	63	64	59	50	53	50	37	20
70 and over.....	164	6	19	21	18	22	18	19	14	33

University of Missouri

**Table 2B**

**Employee Distribution by Age and Years of Service**

**Level One Clerical and Service  
As of October 1, 2017**

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.....	3,534	23	1,111	870	640	353	253	162	94	28
20 - 24.....	2	0	2	0	0	0	0	0	0	0
25 - 29.....	102	4	97	1	0	0	0	0	0	0
30 - 34.....	249	4	193	52	0	0	0	0	0	0
35 - 39.....	332	3	151	137	38	3	0	0	0	0
40 - 44.....	335	2	112	120	74	27	0	0	0	0
45 - 49.....	506	1	141	139	112	71	40	2	0	0
50 - 54.....	610	4	151	114	127	85	70	54	5	0
55 - 59.....	756	4	135	184	149	82	79	62	54	7
60 - 64.....	490	0	97	90	100	72	50	37	30	14
65 - 69.....	124	1	27	26	29	12	12	7	5	5
70 and over .....	28	0	5	7	11	1	2	0	0	2

University of Missouri

**Table 2C**

**Employee Distribution by Age and Years of Service**

**Level Two Academic and Administrative  
As of October 1, 2017**

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.....	4,714	4,678	36	0	0	0	0	0	0	0
20 - 24.....	303	303	0	0	0	0	0	0	0	0
25 - 29.....	983	981	2	0	0	0	0	0	0	0
30 - 34.....	1,057	1,048	9	0	0	0	0	0	0	0
35 - 39.....	746	741	5	0	0	0	0	0	0	0
40 - 44.....	492	483	9	0	0	0	0	0	0	0
45 - 49.....	378	376	2	0	0	0	0	0	0	0
50 - 54.....	294	291	3	0	0	0	0	0	0	0
55 - 59.....	225	224	1	0	0	0	0	0	0	0
60 - 64.....	165	162	3	0	0	0	0	0	0	0
65 - 69.....	56	55	1	0	0	0	0	0	0	0
70 and over .....	15	14	1	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, 2017**

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.....	2,824	2,795	29	0	0	0	0	0	0	0	0
Under 20.....	36	36	0	0	0	0	0	0	0	0	0
20 - 24.....	463	463	0	0	0	0	0	0	0	0	0
25 - 29.....	714	713	1	0	0	0	0	0	0	0	0
30 - 34.....	439	430	9	0	0	0	0	0	0	0	0
35 - 39.....	295	290	5	0	0	0	0	0	0	0	0
40 - 44.....	220	217	3	0	0	0	0	0	0	0	0
45 - 49.....	225	223	2	0	0	0	0	0	0	0	0
50 - 54.....	172	167	5	0	0	0	0	0	0	0	0
55 - 59.....	154	153	1	0	0	0	0	0	0	0	0
60 - 64.....	87	85	2	0	0	0	0	0	0	0	0
65 - 69.....	12	11	1	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, 2017**

Annual salary	Academic and Administrative		Clerical and Service	
	Number	Percent	Number	Percent
Under \$20,000 .....	1	0.0%	17	0.5%
\$20,000 - 24,999 .....	1	0.0	111	3.1
25,000 - 29,999 .....	19	0.3	689	19.5
30,000 - 34,999 .....	71	1.0	804	22.8
35,000 - 39,999 .....	233	3.3	589	16.7
40,000 - 44,999 .....	312	4.4	474	13.4
45,000 - 49,999 .....	607	8.6	427	12.1
50,000 - 54,999 .....	601	8.5	213	6.0
55,000 - 59,999 .....	570	8.1	82	2.3
60,000 - 64,999 .....	591	8.4	43	1.2
65,000 - 69,999 .....	533	7.5	40	1.1
70,000 - 74,999 .....	505	7.1	11	0.3
75,000 - 79,999 .....	400	5.7	24	0.7
80,000 - 84,999 .....	290	4.1	6	0.2
85,000 - 89,999 .....	290	4.1	2	0.1
90,000 - 94,999 .....	224	3.2	1	0.0
95,000 - 99,999 .....	204	2.9	0	0.0
100,000 - 104,999 .....	154	2.2	0	0.0
105,000 - 109,999 .....	145	2.1	0	0.0
110,000 - 114,999 .....	147	2.1	1	0.0
115,000 - 119,999 .....	89	1.3	0	0.0
120,000 - 124,999 .....	90	1.3	0	0.0
125,000 - 129,999 .....	83	1.2	0	0.0
130,000 - 134,999 .....	70	1.0	0	0.0
135,000 - 139,999 .....	60	0.8	0	0.0
140,000 - 144,999 .....	67	0.9	0	0.0
145,000 - 149,999 .....	57	0.8	0	0.0
150,000 and over .....	649	9.2	0	0.0
<b>Total .....</b>	<b>7,063</b>	<b>100.0</b>	<b>3,534</b>	<b>100.0</b>

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, 2017**

Annual salary	Academic and Administrative		Clerical and Service	
	Number	Percent	Number	Percent
Under \$20,000 .....	6	0.1%	91	3.2%
\$20,000 - 24,999 .....	12	0.3	594	21.0
25,000 - 29,999 .....	120	2.5	791	28.0
30,000 - 34,999 .....	140	3.0	567	20.1
35,000 - 39,999 .....	521	11.1	331	11.7
40,000 - 44,999 .....	583	12.4	236	8.4
45,000 - 49,999 .....	859	18.2	95	3.4
50,000 - 54,999 .....	459	9.7	71	2.5
55,000 - 59,999 .....	285	6.0	30	1.1
60,000 - 64,999 .....	275	5.8	10	0.4
65,000 - 69,999 .....	208	4.4	2	0.1
70,000 - 74,999 .....	151	3.2	4	0.1
75,000 - 79,999 .....	140	3.0	1	0.0
80,000 - 84,999 .....	124	2.6	1	0.0
85,000 - 89,999 .....	94	2.0	0	0.0
90,000 - 94,999 .....	84	1.8	0	0.0
95,000 - 99,999 .....	46	1.0	0	0.0
100,000 - 104,999 .....	51	1.1	0	0.0
105,000 - 109,999 .....	50	1.1	0	0.0
110,000 - 114,999 .....	38	0.8	0	0.0
115,000 - 119,999 .....	25	0.5	0	0.0
120,000 - 124,999 .....	23	0.5	0	0.0
125,000 - 129,999 .....	22	0.5	0	0.0
130,000 - 134,999 .....	19	0.4	0	0.0
135,000 - 139,999 .....	8	0.2	0	0.0
140,000 - 144,999 .....	30	0.6	0	0.0
145,000 - 149,999 .....	26	0.6	0	0.0
150,000 and over .....	315	6.7	0	0.0
<b>Total .....</b>	<b>4,714</b>	<b>100.0</b>	<b>2,824</b>	<b>100.0</b>

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

University of Missouri

**Table 4**

**Pensions in Force on October 1, 2017  
By Monthly Amount**

<b>Monthly amount</b>	<b>Total</b>	<b>Academic and Administrative</b>	<b>Clerical and Service</b>
Less than \$100.....	73	21	52
\$100 - 199.....	309	128	181
200 - 299.....	454	164	290
300 - 399.....	456	178	278
400 - 499.....	485	218	267
500 - 599.....	463	181	282
600 - 699.....	413	183	230
700 - 799.....	373	182	191
800 - 899.....	373	199	174
900 - 999.....	338	175	163
1,000 - 1,199.....	649	351	298
1,200 - 1,399.....	509	272	237
1,400 - 1,599.....	420	258	162
1,600 - 1,799.....	396	284	112
1,800 - 1,999.....	309	204	105
2,000 - 2,199.....	288	209	79
2,200 - 2,399.....	240	186	54
2,400 - 2,599.....	208	171	37
2,600 - 2,799.....	191	170	21
2,800 - 2,999.....	194	164	30
3,000 - 3,399.....	318	287	31
3,400 - 3,799.....	259	250	9
3,800 - 4,199.....	210	202	8
4,200 - 4,599.....	164	161	3
4,600 - 4,999.....	106	105	1
5,000 and over.....	528	522	6
<b>Total .....</b>	<b>8,726</b>	<b>5,425</b>	<b>3,301</b>

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, 2017  
by Age**

<b>Age on October 1, 2017</b>	<b>Total</b>	<b>Academic and Administrative</b>	<b>Clerical and Service</b>
55 - 59.....	246	122	124
60 - 64.....	1,030	559	471
65 - 69.....	2,291	1,364	927
70 - 74.....	2,007	1,294	713
75 - 79.....	1,408	921	487
80 - 84.....	881	572	309
85 - 89.....	565	391	174
90 - 94.....	225	154	71
95 - 99.....	66	44	22
100 and over.....	7	4	3
<b>Total</b>	<b>8,726</b>	<b>5,425</b>	<b>3,301</b>

Note: Excludes beneficiaries of deceased retirees.

University of Missouri



**Table 6**

**Pensions Awarded in the Year Ended September 30, 2017  
by Monthly Amount**

<b>Monthly amount</b>	<b>Total</b>	<b>Academic and Administrative</b>	<b>Clerical and Service</b>
Less than \$100.....	2	0	2
\$100 - 199.....	11	6	5
200 - 299.....	20	0	20
300 - 399.....	29	10	19
400 - 499.....	39	19	20
500 - 599.....	29	11	18
600 - 699.....	22	8	14
700 - 799.....	30	16	14
800 - 899.....	36	16	20
900 - 999.....	23	11	12
1,000 - 1,199.....	76	38	38
1,200 - 1,399.....	58	29	29
1,400 - 1,599.....	44	24	20
1,600 - 1,799.....	38	23	15
1,800 - 1,999.....	31	21	10
2,000 - 2,199.....	26	15	11
2,200 - 2,399.....	16	8	8
2,400 - 2,599.....	26	21	5
2,600 - 2,799.....	19	16	3
2,800 - 2,999.....	21	15	6
3,000 - 3,399.....	33	24	9
3,400 - 3,799.....	25	22	3
3,800 - 4,199.....	18	18	0
4,200 - 4,599.....	10	10	0
4,600 - 4,999.....	14	14	0
5,000 and over.....	55	51	4
<b>Total .....</b>	<b>751</b>	<b>446</b>	<b>305</b>

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, 2017  
by Age**

<b>Age on Effective Date</b>	<b>Total</b>	<b>Academic and Administrative</b>	<b>Clerical and Service</b>
55 - 59 .....	143	77	66
60 - 64 .....	279	152	127
65 - 69 .....	267	173	94
70 - 74 .....	47	33	14
75 - 79 .....	12	8	4
80 & over .....	3	3	0
<b>Total .....</b>	<b>751</b>	<b>446</b>	<b>305</b>
Average age at retirement .....	63.9	64.4	63.1

University of Missouri

**Table 8**

**Development of Actuarial Value of Assets  
As of September 30, 2017**

1. Market value of assets, September 30, 2017			\$3,572,074,894
2. Calculation of Unrecognized Return *	<b><u>Original Amount</u></b>	<b><u>Unrecognized Return</u></b>	
(a) Year ended September 30, 2017	\$119,947,402	\$95,957,921	
(b) Year ended September 30, 2016	43,926,675	26,356,005	
(c) Year ended September 30, 2015	(308,266,343)	(123,306,538)	
(d) Year ended September 30, 2014	4,583,904	916,781	
(e) Year ended September 30, 2013	88,950,101	<u>0</u>	
(f) Total Unrecognized Return			(75,831)
3. Preliminary actuarial value: (1) – (2f)			\$3,572,150,725
4. Adjustment to be within 20% corridor			0
5. Final actuarial value of assets as of September 30, 2017: (3) + (4)			\$3,572,150,725
6. Actuarial value as a percentage of market value: (5)/(1)			100.0%

\* 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, 2017**

	<b>Market Value</b>	<b>Actuarial Value</b>
<b><u>Income</u></b>		
Employer contributions .....	\$95,810,737	\$95,810,737
Employee contributions.....	15,272,789	15,272,789
Investments:		
Income .....	\$66,431,292	N/A
Net gain / (loss) from sales of investments.....	143,267,299	N/A
Unrealized appreciation (depreciation) .....	184,583,098	N/A
Actuarial value recognition .....	<u>N/A</u>	
Total investment income gain	394,281,689	241,833,647
Total income .....	\$505,365,215	\$352,917,173
<b><u>Disbursements</u></b>		
Total benefit payments .....	\$(214,201,700)	\$(214,201,700)
Expenses.....	<u>(22,328,988)</u>	<u>N/A</u>
Total disbursements.....	(236,530,688)	(214,201,700)
Excess (shortfall) of income over disbursements.....	268,834,527	138,715,473
Fund balance, September 30, 2016.....	3,303,240,367	3,433,435,252
Adjustment* .....	<u>N/A</u>	<u>0</u>
Fund balance value, September 30, 2017.....	\$3,572,074,894	\$3,572,150,725
Net returns** .....	11.44%	7.15%

\* 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, 2017**

	<b>Academic and Administrative</b>	<b>Clerical and Service</b>	<b>Total</b>
Actuarial Accrued Liability Components:			
Active members .....	\$1,699,721,134	\$394,429,555	\$2,094,150,689
Inactive vested members .....	205,668,739	47,520,304	253,189,043
Retirees and beneficiaries .....	<u>1,572,493,658</u>	<u>391,028,898</u>	<u>1,963,522,556</u>
Total Actuarial Accrued Liability .....			\$4,310,862,288
Actuarial Value of Assets .....			\$3,572,150,725
Total Unfunded Actuarial Accrued Liability.....			\$738,711,563

University of Missouri

**Table 11**

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

<b>October 1:</b>	<b>Dollar Amount</b>	<b>Percent of Payroll</b>
2008	\$(75,094,017)	(7.9)%
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

Note: Based on actuarial value of assets.

University of Missouri

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

<b>October 1:</b>	<b>Market Value of Assets</b>	<b>Actuarial Value of Assets</b>
2008	88.8%	102.7%
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

University of Missouri

**Table 13**

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

	For Plan Year Beginning October 1									
	2013		2014		2015		2016		2017	
	Level One	Level Two	Level One	Level Two	Level One	Level Two	Level One	Level Two	Level One	Level Two
Normal cost percentage	7.30%	3.27%	7.28%	3.26%	7.26%	3.24%	7.26%	3.24%	7.12%	3.32%
Amortization percentage*	3.98	3.98	3.63	3.63	3.59	3.59	3.47	3.47	5.37%	5.37%
Total contribution rate	11.28	7.26	10.91	6.89	10.85	6.83	10.72	6.71	12.50%	8.69%
Employee contribution rate	1.29	1.21	1.30	1.21	1.32	1.21	1.33	1.23	1.34	1.23
Net contribution rate	9.99	6.05	9.61	5.68	9.53	5.61	9.39	5.48	11.16%	7.46%

\* 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>
2013	9.65%
2014	8.97%
2015	8.59%
2016	8.20%
2017	9.83%

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



### **III. SUMMARY OF PRINCIPAL PLAN PROVISIONS**

The 2017 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

There following changes in actuarial assumptions were made with this 2017 actuarial valuation:

- Investment return
- Mortality for healthy and disabled lives
- Salary and payroll increases, including the assumed rate of inflation
- Rates of retirement for active employees
- Withdrawal (or turnover) rates

The actuarial cost methods used in this 2017 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 judgement, no additional 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 2017 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, 2017, the total rate of return on an actuarial value basis was approximately 7.15%. The schedule that follows shows the total rate of investment return for each of the past ten fiscal years.

<b>Fiscal Year Ended September 30:</b>	<b>Total Rate of Return (Actuarial Value of Assets)</b>
2008	7.91%
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

\* 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 2017 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 2017 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 2017 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

<b>Clerical and Service</b>		
<b>Attained Age</b>	<b>Under 25 Years of Service</b>	<b>Over 25 Years of Service</b>
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 2017 actuarial valuation are shown below for selected years of service:

<b>Years of Service</b>	<b>Withdrawal Rates</b>	
	<b>Academic and Administrative</b>	<b>Clerical and Service</b>
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 2017 valuation are shown below for selected ages:

<b>Age</b>	<b>Disability Rates</b>
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 2017 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 2017 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:

<b>Age</b>	<b>Mortality Rates</b>		<b>Expected Years of Life Remaining</b>	
	<b>Male</b>	<b>Female</b>	<b>Male</b>	<b>Female</b>
60	0.78%	0.53%	25.6	27.9
70	1.65	1.25	17.2	19.0
80	4.35	3.42	10.0	11.3
90	13.31	10.57	4.9	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 5.486 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, 2017.

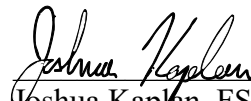
Actuarial calculations were made with respect to 18,135 covered active members, 4,659 inactive members with vested benefit rights, and 9,763 pensioners and beneficiaries.

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

Total Normal Cost.....	\$65,979,258
Total Actuarial Accrued Liability .....	4,310,862,288
Assets at Actuarial Value.....	3,572,150,725
Total Unfunded Actuarial Accrued Liability .....	738,711,563
Payment to amortize unfunded actuarial accrued liability over 26 years .....	61,615,901
Total payroll.....	1,146,835,961
Total Contribution Requirement	
Dollar .....	\$127,595,159
Percent of payroll.....	11.13%
Expected Employee Contribution	
Dollar .....	\$14,908,183
Percent of payroll.....	1.30%
Total Net Contribution Requirement	
Dollar .....	\$112,686,976
Percent of payroll.....	9.83%

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, 2017 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

8688465v1/03731.001