Table 1: Summary of goodness of fit statistics for gamma distribution data sets, with $\lambda = 1$. Arithmetic mean and standard deviation (sd) of a sample of 100 p-values and 100 p^*-values, and correlation (cor) between them. $mean = \frac{1}{100}\sum_{i=1}^{100} p_i$ $sd = \sqrt{\frac{1}{99}\sum_{i=1}^{100}(p_i - \overline{p})^2}$

n	k	p_D-value mean (sd)	p^*_D-value mean (sd)	cor	p_{X^2}-value mean (sd)	$p^*_{X^2}$-value mean (sd)	cor
15	3	0.410 (0.295)	0.523 (0.299)	0.987	0.669 (0.242)	0.536 (0.294)	0.985
30	3	0.331 (0.269)	0.494 (0.284)	0.973	0.632 (0.271)	0.501 (0.288)	0.984
100	3	0.246 (0.219)	0.528 (0.293)	0.939	0.622 (0.335)	0.538 (0.303)	0.989
200	3	0.139 (0.152)	0.514 (0.271)	0.887	0.588 (0.307)	0.521 (0.275)	0.991
15	5	0.434 (0.308)	0.536 (0.305)	0.990	0.709 (0.205)	0.580 (0.269)	0.987
30	5	0.372 (0.284)	0.532 (0.297)	0.974	0.665 (0.279)	0.509 (0.295)	0.972
100	5	0.241 (0.250)	0.515 (0.285)	0.901	0.607 (0.319)	0.495 (0.293)	0.985
200	5	0.155 (0.179)	0.528 (0.281)	0.844	0.593 (0.336)	0.514 (0.309)	0.986
30	10	0.325 (0.266)	0.481 (0.284)	0.974	0.683 (0.229)	0.459 (0.288)	0.959
100	10	0.243 (0.246)	0.515 (0.299)	0.914	0.706 (0.279)	0.526 (0.291)	0.956
200	10	0.196 (0.217)	0.576 (0.282)	0.868	0.671 (0.303)	0.534 (0.293)	0.974
100	15	0.188 (0.215)	0.452 (0.287)	0.912	0.718 (0.230)	0.459 (0.269)	0.949
200	15	0.156 (0.209)	0.503 (0.295)	0.844	0.714 (0.279)	0.523 (0.284)	0.954
100	25	0.212 (0.216)	0.488 (0.288)	0.923	0.787 (0.202)	0.460 (0.302)	0.907
200	25	0.131 (0.171)	0.490 (0.286)	0.841	0.756 (0.225)	0.460 (0.291)	0.908
200	50	0.103 (0.146)	0.441 (0.281)	0.836	0.890 (0.136)	0.454 (0.283)	0.827

Table 2: Summary of goodness of fit statistics for gamma distribution data sets, with $\lambda = 1$.
$mean = \frac{1}{100}\sum_{i=1}^{100} p_i \quad sd = \sqrt{\frac{1}{100^2}\sum_{i=1}^{100} p_i(1-p_i)}$

n	k	p_D-value			p_D^*-value			cor	p_{X^2}-value			$p_{X^2}^*$-value			cor
		mean	(sd)	rej	mean	(sd)	rej		mean	(sd)	rej	mean	(sd)	rej	
15	3	0.410	(0.039)	11	0.523	(0.040)	7	0.987	0.669	(0.040)	0	0.536	(0.040)	3	0.985
30	3	0.331	(0.039)	15	0.494	(0.041)	6	0.973	0.632	(0.040)	0	0.501	(0.041)	1	0.984
100	3	0.246	(0.037)	27	0.528	(0.041)	4	0.939	0.622	(0.035)	10	0.538	(0.040)	8	0.989
200	3	0.139	(0.031)	39	0.514	(0.042)	2	0.887	0.588	(0.039)	3	0.521	(0.042)	2	0.991
15	5	0.434	(0.039)	11	0.536	(0.040)	4	0.990	0.709	(0.041)	0	0.580	(0.041)	2	0.987
30	5	0.372	(0.039)	15	0.532	(0.040)	5	0.974	0.665	(0.038)	3	0.509	(0.040)	8	0.972
100	5	0.241	(0.035)	26	0.515	(0.041)	5	0.901	0.607	(0.037)	5	0.495	(0.041)	5	0.985
200	5	0.155	(0.032)	34	0.528	(0.041)	7	0.844	0.593	(0.036)	7	0.514	(0.039)	7	0.986
30	10	0.325	(0.039)	17	0.481	(0.041)	3	0.974	0.683	(0.041)	0	0.459	(0.041)	9	0.959
100	10	0.243	(0.035)	28	0.515	(0.040)	6	0.914	0.706	(0.036)	3	0.526	(0.041)	6	0.956
200	10	0.196	(0.033)	36	0.576	(0.041)	1	0.868	0.671	(0.036)	2	0.534	(0.040)	3	0.974
100	15	0.188	(0.033)	34	0.452	(0.041)	7	0.912	0.718	(0.039)	0	0.459	(0.042)	2	0.949
200	15	0.156	(0.030)	43	0.503	(0.040)	5	0.844	0.714	(0.036)	3	0.523	(0.041)	5	0.954
100	25	0.212	(0.035)	29	0.488	(0.041)	8	0.923	0.787	(0.036)	0	0.460	(0.040)	6	0.907
200	25	0.131	(0.029)	46	0.490	(0.041)	6	0.841	0.756	(0.037)	1	0.460	(0.041)	3	0.908
200	50	0.103	(0.027)	51	0.441	(0.041)	7	0.836	0.890	(0.028)	0	0.454	(0.041)	5	0.827

Table 3: Summary of goodness of fit statistics for negative binomial distribution data sets, with $\lambda = 5$. Arithmetic mean and standard deviation (sd) of a sample of 100 p-values and 100 p^*-values, and correlation (cor) between them.

$mean = \frac{1}{100}\sum_{i=1}^{100} p_i \quad sd = \sqrt{\frac{1}{99}\sum_{i=1}^{100}(p_i - \overline{p})^2}$

n	k	p_D-value mean (sd)	p^*_D-value mean (sd)	cor	p_{X^2}-value mean (sd)	$p^*_{X^2}$-value mean (sd)	cor
15	3	0.405 (0.282)	0.527 (0.298)	0.976	0.557 (0.275)	0.532 (0.304)	0.994
30	3	0.336 (0.235)	0.510 (0.268)	0.967	0.531 (0.279)	0.502 (0.284)	0.998
100	3	0.237 (0.220)	0.496 (0.298)	0.924	0.518 (0.301)	0.498 (0.293)	0.999
200	3	0.164 (0.180)	0.510 (0.289)	0.881	0.552 (0.292)	0.536 (0.283)	0.999
15	5	0.401 (0.275)	0.525 (0.292)	0.968	0.553 (0.256)	0.533 (0.285)	0.990
30	5	0.339 (0.228)	0.511 (0.286)	0.973	0.548 (0.269)	0.511 (0.287)	0.996
100	5	0.203 (0.192)	0.459 (0.278)	0.941	0.503 (0.280)	0.474 (0.275)	0.999
200	5	0.176 (0.191)	0.515 (0.306)	0.862	0.521 (0.328)	0.503 (0.317)	0.999
30	10	0.367 (0.260)	0.511 (0.289)	0.971	0.573 (0.267)	0.521 (0.292)	0.989
100	10	0.275 (0.238)	0.506 (0.295)	0.949	0.542 (0.294)	0.498 (0.296)	0.997
200	10	0.204 (0.199)	0.536 (0.262)	0.883	0.581 (0.268)	0.545 (0.265)	0.998
100	15	0.333 (0.275)	0.543 (0.300)	0.963	0.612 (0.283)	0.557 (0.295)	0.996
200	15	0.238 (0.238)	0.510 (0.295)	0.926	0.552 (0.307)	0.510 (0.305)	0.997
100	25	0.290 (0.266)	0.498 (0.292)	0.947	0.586 (0.281)	0.501 (0.302)	0.989
200	25	0.165 (0.180)	0.431 (0.282)	0.927	0.511 (0.287)	0.442 (0.283)	0.996
200	50	0.164 (0.203)	0.457 (0.279)	0.885	0.597 (0.265)	0.475 (0.284)	0.982

Table 4: Summary of goodness of fit statistics for negative binomial distribution data sets, with $\lambda = 5$.

$mean = \frac{1}{100}\sum_{i=1}^{100} p_i \quad sd = \sqrt{\frac{1}{100^2}\sum_{i=1}^{100} p_i(1-p_i)}$

n	k	p_D-value			p^*_D-value			cor	p_{X^2}-value			$p^*_{X^2}$-value			cor
		mean	(sd)	rej	mean	(sd)	rej		mean	(sd)	rej	mean	(sd)	rej	
15	3	0.405	(0.040)	6	0.527	(0.040)	2	0.976	0.557	(0.041)	0	0.532	(0.040)	4	0.994
30	3	0.336	(0.041)	7	0.510	(0.042)	2	0.967	0.531	(0.041)	3	0.502	(0.041)	6	0.998
100	3	0.237	(0.036)	23	0.496	(0.040)	7	0.924	0.518	(0.040)	9	0.498	(0.041)	7	0.999
200	3	0.164	(0.032)	33	0.510	(0.041)	4	0.881	0.552	(0.040)	5	0.536	(0.041)	4	0.999
15	5	0.401	(0.041)	5	0.525	(0.041)	4	0.968	0.553	(0.043)	1	0.533	(0.041)	4	0.990
30	5	0.339	(0.042)	3	0.511	(0.041)	3	0.973	0.548	(0.042)	3	0.511	(0.041)	4	0.996
100	5	0.203	(0.035)	19	0.459	(0.041)	4	0.941	0.503	(0.042)	4	0.474	(0.042)	4	0.999
200	5	0.176	(0.033)	34	0.515	(0.040)	9	0.862	0.521	(0.038)	9	0.503	(0.039)	7	0.999
30	10	0.367	(0.041)	6	0.511	(0.041)	3	0.971	0.573	(0.042)	4	0.521	(0.041)	7	0.989
100	10	0.275	(0.038)	23	0.506	(0.040)	4	0.949	0.542	(0.040)	5	0.498	(0.040)	5	0.997
200	10	0.204	(0.035)	25	0.536	(0.042)	2	0.883	0.581	(0.041)	3	0.545	(0.042)	3	0.998
100	15	0.333	(0.038)	10	0.543	(0.040)	3	0.963	0.612	(0.040)	1	0.557	(0.040)	3	0.996
200	15	0.238	(0.035)	25	0.510	(0.040)	6	0.926	0.552	(0.039)	6	0.510	(0.040)	6	0.997
100	25	0.290	(0.037)	15	0.498	(0.041)	6	0.947	0.586	(0.041)	2	0.501	(0.040)	6	0.989
200	25	0.165	(0.032)	37	0.431	(0.041)	8	0.927	0.511	(0.041)	2	0.442	(0.041)	2	0.996
200	50	0.164	(0.031)	36	0.457	(0.041)	5	0.885	0.597	(0.041)	2	0.475	(0.041)	8	0.982