

```

In [1]: from statlib import qtrng
In [5]: studentized_range = [
....:     [26.976, 32.819, 37.081, 40.407, 43.118,
45.397, 47.356, 49.07],
....:     [8.331, 9.798, 10.881, 11.734, 12.434, 13.027,
13.538, 13.987],
....:     [5.91, 6.825, 7.502, 8.037, 8.478, 8.852,
9.177, 9.462],
....:     [5.04, 5.757, 6.287, 6.706, 7.053, 7.347,
7.602, 7.826],
....:     [4.602, 5.218, 5.673, 6.033, 6.33, 6.582,
6.801, 6.995],
....:     [4.339, 4.896, 5.305, 5.629, 5.895, 6.122,
6.319, 6.493],
....:     [4.165, 4.681, 5.06, 5.359, 5.606, 5.815,
5.997, 6.158],
....:     [4.041, 4.529, 4.886, 5.167, 5.399, 5.596,
5.767, 5.918],
....:     [3.948, 4.415, 4.755, 5.024, 5.244, 5.432,
5.595, 5.738],
....:     [3.877, 4.327, 4.654, 4.912, 5.124, 5.304,
5.46, 5.598],
....:     [3.82, 4.256, 4.574, 4.823, 5.028, 5.202,
5.353, 5.486],
....:     [3.773, 4.199, 4.508, 4.748, 4.947, 5.116,
5.262, 5.395],
....:     [3.734, 4.151, 4.453, 4.69, 4.884, 5.049,
5.192, 5.318],
....:     [3.701, 4.111, 4.407, 4.639, 4.829, 4.99,
5.13, 5.253],
....:     [3.673, 4.076, 4.367, 4.595, 4.782, 4.94,
5.077, 5.198],
....:     [3.649, 4.046, 4.333, 4.557, 4.741, 4.896,
5.031, 5.15],
....:     [3.628, 4.02, 4.303, 4.524, 4.705, 4.858,
4.991, 5.108],
....:     [3.609, 3.997, 4.276, 4.494, 4.673, 4.824,
4.955, 5.071],
....:     [3.593, 3.977, 4.253, 4.468, 4.645, 4.794,
4.924, 5.037],
....:     [3.578, 3.958, 4.232, 4.445, 4.62, 4.768,
4.895, 5.008],

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    ....: [3.565, 3.942, 4.213, 4.424, 4.597, 4.743,
4.87, 4.981],
    ....: [3.553, 3.927, 4.196, 4.405, 4.577, 4.722,
4.847, 4.957],
    ....: [3.542, 3.914, 4.18, 4.388, 4.558, 4.702,
4.826, 4.935],
    ....: [3.532, 3.901, 4.166, 4.373, 4.541, 4.684,
4.807, 4.915],
    ....: [3.523, 3.89, 4.153, 4.358, 4.526, 4.667,
4.789, 4.897],
    ....: [3.514, 3.88, 4.141, 4.345, 4.511, 4.652,
4.773, 4.88],
    ....: [3.506, 3.87, 4.13, 4.333, 4.498, 4.638,
4.758, 4.864],
    ....: [3.499, 3.861, 4.12, 4.322, 4.486, 4.625,
4.745, 4.85],
    ....: [3.493, 3.853, 4.111, 4.311, 4.475, 4.613,
4.732, 4.837],
    ....: [3.487, 3.845, 4.102, 4.301, 4.464, 4.601,
4.72, 4.824],
    ....: [3.481, 3.838, 4.094, 4.292, 4.454, 4.591,
4.709, 4.813]
    ....: ]
    ....:

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In [32]: qrt = np.zeros((31, 8))
In [33]: for i in range(0, 31):
    ....:     for j in range(0, 8):
    ....:         qrt[i,j] = qtrng(.95, i+1,j+3, [1,2,3])
In [46]: for i in range(len(studentized_range)):
    ....:     for j in range(len(studentized_range[0])):
    ....:         print(f"difference:
{np.abs(studentized_range[i][j] - qrt[i][j])}")
    ....:
    ....:
difference: 0.2763405399325869
difference: 0.032251602695197334
difference: 0.013412865890337855
difference: 0.5626677627030645
difference: 0.4470161239507888
difference: 0.34811073139918136
difference: 0.25583042818846735
difference: 0.18062927739087797

```

difference: 0.023042338611395152
difference: 0.007381460422614339
difference: 0.00874928935626329
difference: 0.0311491320883146
difference: 0.09056281319660187
difference: 0.22579182064911762
difference: 0.3332965522327953
difference: 0.4304071288272464
difference: 0.00027815499943706357
difference: 0.0029364824416662216
difference: 0.043106676569721
difference: 0.0036543844901579803
difference: 0.024707313748319137
difference: 0.04754697517192241
difference: 0.0663051259495866
difference: 0.10048781322666223
difference: 0.0032827029052819867
difference: 0.0034923672786062454
difference: 0.03176805866646859
difference: 0.025060907385576314
difference: 0.0242328384015833
difference: 0.024148396387523974
difference: 0.02440086536561381
difference: 0.023697618136697685
difference: 0.002770551727523163
difference: 0.0032379987574566726
difference: 0.025863071297239415
difference: 0.002033272225911098
difference: 0.0017316704497369884
difference: 0.002590342140251778
difference: 0.0027441458501220595
difference: 0.001861470790930575
difference: 0.002940977234242581
difference: 0.016570870251670478
difference: 0.020080444432921674
difference: 0.0010790890579936985
difference: 0.0021599040533253344
difference: 0.002083076888647284
difference: 0.001965855729229915
difference: 0.0019881016272238483
difference: 0.01649213727306531
difference: 0.007511555254719582
difference: 0.01403190457244552

difference: 0.0019604984538075243
difference: 0.0013045188948579423
difference: 0.0019154198371911235
difference: 0.002003409325218364
difference: 0.0015493012365004333
difference: 0.006908760400739844
difference: 0.0018134912312675056
difference: 0.008956830043542752
difference: 0.018586921022027525
difference: 0.0014698464108233722
difference: 0.0018290537395095896
difference: 0.0017269299047564246
difference: 0.0016879305828112479
difference: 3.3600929918886635e-05
difference: 0.0030449172416284753
difference: 0.003476746772252959
difference: 0.013810853746304197
difference: 0.001757207663231064
difference: 0.0014408272030452807
difference: 0.0010581452986739848
difference: 0.0016792513232788409
difference: 0.003979225687051446
difference: 0.006571477903929868
difference: 0.0006907912299896068
difference: 0.008229718482454018
difference: 0.016716956553132434
difference: 0.0015717078892523162
difference: 0.0017558024055102095
difference: 0.0015762092084887769
difference: 0.007271670972716748
difference: 0.010287661165714113
difference: 0.0037744632914851195
difference: 0.0036176025696876835
difference: 0.01120954651551731
difference: 0.001372485732363593
difference: 0.0013144538101999004
difference: 0.0015963595729751034
difference: 0.010292990609524821
difference: 0.012450304866715278
difference: 0.0072327538069050235
difference: 0.0028647273453445976
difference: 0.0036099319359053084
difference: 0.009832075726012413

difference: 0.004419427666260134
difference: 0.0008073889010100643
difference: 0.012622664713342946
difference: 0.014909154354080911
difference: 0.010397653065298051
difference: 0.004147659528354275
difference: 0.0013158572939646618
difference: 0.006910532080969034
difference: 0.01182735858274686
difference: 0.0012960823342780259
difference: 0.014580685653424297
difference: 0.01947181520907204
difference: 0.012747024417538277
difference: 0.0074379523396777
difference: 0.00265792686465538
difference: 0.0017408160339718037
difference: 0.00608663681834809
difference: 0.009431170688227297
difference: 0.015964798965644178
difference: 0.02194572431966968
difference: 0.015490803251112517
difference: 0.0107563085655773
difference: 0.006177509033089557
difference: 0.0024124363859270304
difference: 0.0009831924634209344
difference: 0.004135785184931962
difference: 0.01966418109020429
difference: 0.023845590102419045
difference: 0.020476506693597685
difference: 0.013661889989561082
difference: 0.009691033333231402
difference: 0.006903505205156257
difference: 0.003755945730592458
difference: 0.0010580406803368803
difference: 0.02066803489866631
difference: 0.025314276600486352
difference: 0.022802490759491256
difference: 0.01902569536493015
difference: 0.013043491950512909
difference: 0.010508331907038482
difference: 0.007846904808147315
difference: 0.005813673877805847
difference: 0.022004019864105828

difference: 0.02671365682633553
difference: 0.025467496215446417
difference: 0.022606284267541632
difference: 0.019239473465775703
difference: 0.014297991276134958
difference: 0.012315823763374922
difference: 0.010117617225412268
difference: 0.022323799378094034
difference: 0.027550249426620876
difference: 0.02690432346602023
difference: 0.025196539738426615
difference: 0.02235978619804424
difference: 0.02068965025120484
difference: 0.018283342001532255
difference: 0.015187710973934898
difference: 0.023276677459093342
difference: 0.029371118475933766
difference: 0.028665231047436457
difference: 0.027342243117356446
difference: 0.025197969994692038
difference: 0.02334121755963725
difference: 0.02308970443009084
difference: 0.02192379264041744
difference: 0.023629062939019896
difference: 0.030001777753898562
difference: 0.030394455950896848
difference: 0.029620394134280303
difference: 0.02834234616543796
difference: 0.027529390475684146
difference: 0.026410301078647613
difference: 0.026507727270255188
difference: 0.02418415634954929
difference: 0.031107530035475506
difference: 0.03176763676597094
difference: 0.031742731281793723
difference: 0.03042544701526584
difference: 0.029742311848981018
difference: 0.029868980742189244
difference: 0.030310343401133366
difference: 0.024770157583534846
difference: 0.031491582749542335
difference: 0.03360767531203557
difference: 0.03344054517492889

difference: 0.03318752030725047
difference: 0.03272103928710379
difference: 0.03317136195586645
difference: 0.034007008338997835
difference: 0.025284620666686575
difference: 0.03298649947367904
difference: 0.03471643776183786
difference: 0.03450346305406704
difference: 0.03538764108432613
difference: 0.03522833846692475
difference: 0.03606664682141414
difference: 0.037370613618394444
difference: 0.025569526350102567
difference: 0.033448461518871486
difference: 0.03592656406387995
difference: 0.03675690888546246
difference: 0.036876451411758104
difference: 0.03806402933538866
difference: 0.03934949135516774
difference: 0.04016620894663081
difference: 0.026550102201863712
difference: 0.03375417908278244
difference: 0.037099867969734746
difference: 0.03805481168816449
difference: 0.03947177296090487
difference: 0.040082264996268435
difference: 0.041760956661780924
difference: 0.04318724167088117
difference: 0.02714625547674432
difference: 0.034827111468048955
difference: 0.03812008747164519
difference: 0.039275871597087786
difference: 0.041050651180555064
difference: 0.0421201683160044
difference: 0.044360944201158325
difference: 0.04632894943991683
difference: 0.027289732090435503
difference: 0.03548881041410379
difference: 0.03889481060869571
difference: 0.04030323538709002
difference: 0.042494574086806125
difference: 0.044066527796461585
difference: 0.045895940611954344

difference: 0.04848667329489054
difference: 0.02691014456540275
difference: 0.03585635859904812
difference: 0.03933404889858405
difference: 0.04206730958526084
difference: 0.04370778534847197
difference: 0.04583071873402211
difference: 0.0482690845472451
difference: 0.05051758036776022
difference: 0.026965143292210225
difference: 0.0367158570410866
difference: 0.04037651758276617
difference: 0.043477677056319664
difference: 0.04561602032946688
difference: 0.04832675280451859
difference: 0.05039049483919378
difference: 0.05331824740389912
difference: 0.02743826178069586
difference: 0.03706974347103431
difference: 0.04096020083058605
difference: 0.044472614342572214
difference: 0.04715750998452517
difference: 0.04945888690190792
difference: 0.05219977115015695
difference: 0.05481907652739171

In [47]: