RoopaSondur_Aug2017_IATST_Lab_Assignment

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Question No 1: (To be solved using R)

Let X1, X2, X3, X4, X5 be independent U(0, 1) random variables. Let X = X1 + X2 + X3 and Y = X3 + X4 + X5. Use the runif() function to simulate 1000 trials of each of these variables. Use these to estimate Cov (X, Y).

```
v = runif(5*1000,0,1)
length(v)
```

```
## [1] 5000
```

```
data_mat = matrix(v, nrow=5, ncol=1000)
rownames(data_mat) <- c('X1', 'X2', 'X3', 'X4', 'X5')
#Dimensions of the data_mat matrix
dim(data_mat)
```

```
## [1]    5 1000
```

```
#Display all the rows and first 10 columns of data_mat matrix
data_mat[,1:10]
```

```
##          [,1]       [,2]       [,3]       [,4]      [,5]       [,6]
## X1 0.6126002 0.86848534 0.64488675 0.12981282 0.4956838 0.20253540
## X2 0.4076758 0.60987631 0.38907118 0.90753425 0.8298948 0.08082392
## X3 0.1151126 0.64017172 0.51836121 0.03440984 0.3538351 0.32090924
## X4 0.7713075 0.85643566 0.09101798 0.71088824 0.1538304 0.62699157
## X5 0.3197746 0.01032701 0.89591081 0.63069289 0.3235964 0.87906148
##          [,7]      [,8]      [,9]     [,10]
## X1 0.5864374 0.1445417 0.8693049 0.6714932
## X2 0.3301707 0.2382556 0.7073291 0.8567541
## X3 0.4573280 0.0356390 0.2463226 0.5936313
## X4 0.7703092 0.6931763 0.2356778 0.1440700
## X5 0.4241962 0.3197985 0.9280706 0.4303136
```

```
#Display all the rows and last 10 columns of data_mat matrix
data_mat[,991:1000]
```

```
##           [,1]      [,2]       [,3]      [,4]      [,5]       [,6]
## X1 0.70135769 0.5109636 0.57086407 0.1604872 0.8582868 0.68249025
## X2 0.52150235 0.4818645 0.07312053 0.3349314 0.1303155 0.95351530
## X3 0.00580407 0.6084629 0.01178263 0.7135840 0.3844971 0.57108023
## X4 0.41713375 0.2899773 0.47517990 0.4076696 0.6753153 0.40481911
## X5 0.94590987 0.7334537 0.13427371 0.9049863 0.7718900 0.04830578
##           [,7]      [,8]        [,9]     [,10]
## X1 0.365760001 0.3850867 0.002831494 0.1090503
## X2 0.004952563 0.7762542 0.541287044 0.6815786
## X3 0.219072075 0.3109558 0.595172966 0.8535487
## X4 0.949660824 0.1089726 0.146406402 0.1363354
## X5 0.768060703 0.2045258 0.533658897 0.2937826
```

```r
X = colSums(data_mat[1:3,]) # X = X1 + X2 + X3
X
```

```
##     [1] 1.1353886 2.1185334 1.5523191 1.0717569 1.6794137 0.6042686
##     [7] 1.3739361 0.4184364 1.8229566 2.1218786 1.6236817 1.6224402
##    [13] 1.2894215 2.3553075 1.8588555 0.9494473 1.0522582 1.8097752
##    [19] 1.7098307 0.8864814 1.1136687 0.8532554 1.4934673 1.0452114
##    [25] 1.6943222 2.6869548 1.3866628 1.4143339 2.0533642 1.2609924
##    [31] 0.9502555 1.5245457 2.4057787 1.3493987 1.3341550 1.4221785
##    [37] 1.5939885 2.0170286 1.6976564 1.2834097 1.9106043 1.1420468
##    [43] 1.7389465 1.3613847 1.6879180 1.7957903 1.1513524 1.6933451
##    [49] 2.2346448 1.4931954 1.9778441 1.7913385 1.9782236 1.7473977
##    [55] 0.2458988 2.1722206 0.9115670 1.7947215 1.8264900 2.1752644
##    [61] 0.6013684 1.0812456 1.7578884 1.1201701 1.9381282 1.9770536
##    [67] 2.0123423 1.4352181 1.1382117 0.9595224 1.9092639 1.7631872
##    [73] 0.6426125 1.3348844 1.5647441 2.3682651 1.4911188 1.5763888
##    [79] 2.1110886 1.2461400 1.5146141 2.0067397 0.8692937 1.7482139
##    [85] 0.7447283 1.9199604 1.4535211 0.8266751 1.9879904 1.3123225
##    [91] 2.2661277 1.6466542 1.1581515 0.5497380 1.5695165 1.1408687
##    [97] 1.4751412 1.7351696 0.6974354 1.5253707 1.6863848 2.4022328
##   [103] 1.0106366 1.8377489 1.0174022 1.2504126 1.2492789 1.4498970
##   [109] 1.5148617 1.9953926 2.7216893 0.7098092 2.1236835 2.7129869
##   [115] 1.9671318 1.8714296 2.0301248 1.5583484 1.2303540 0.9570631
##   [121] 1.4977399 0.5467781 0.7629584 1.9755112 1.4166279 0.8003565
##   [127] 1.3975554 1.4716787 0.9031545 1.8092691 1.5122958 1.2444146
##   [133] 0.7362108 1.9664143 1.9820937 1.0206218 1.2867053 0.8263230
##   [139] 2.1494214 2.6434539 1.9092554 1.2241455 0.9429816 0.8470641
##   [145] 1.7606276 1.5137692 2.0523257 2.0841875 1.2612651 2.1929275
##   [151] 1.7090919 1.5725060 1.3664289 1.1377737 1.5275837 2.5441530
##   [157] 1.2187423 1.9267296 1.5553954 0.7815909 1.6585853 1.9739506
##   [163] 1.2458676 1.5842507 1.3874462 2.1329416 2.1894283 0.6343761
##   [169] 2.1662675 1.1782168 1.2382853 1.0025643 2.2956984 1.1913689
##   [175] 0.9993849 1.0746305 1.9617775 2.3642422 1.8499111 1.3090223
##   [181] 1.8429314 1.7685978 0.9979258 2.3289904 1.1556648 0.7937217
##   [187] 2.1831469 0.9153934 1.2190241 2.1226304 0.3543925 2.0560728
##   [193] 1.8589935 1.8000227 1.1549886 1.6145377 1.2374092 2.0868720
##   [199] 1.8450900 1.8402101 1.6553327 2.4244049 0.9552864 1.4970119
##   [205] 2.1350295 1.5173360 1.4858449 1.0985955 1.2461455 1.4255561
##   [211] 2.0348448 1.7266328 0.6766168 1.1533741 1.9222467 1.6392296
##   [217] 1.3801672 1.5592475 1.1008948 2.2382548 1.3873957 1.1763609
##   [223] 2.0232108 1.3476619 1.1666767 2.4270766 0.9157169 1.3976095
##   [229] 0.7747840 1.7088121 1.2176463 2.2520953 0.9568042 1.9610800
##   [235] 1.3079452 0.9734774 2.1347398 1.0886591 1.9676465 2.1700764
##   [241] 1.3261223 1.6907299 2.3143268 1.3073569 1.5181897 1.9304260
##   [247] 0.7577004 1.5197099 1.8003591 2.1512190 0.2422208 1.2003128
##   [253] 1.6599740 1.4485137 1.5854747 0.4726615 1.5838525 0.9885839
##   [259] 1.7261227 0.6666291 1.3932068 0.7304613 1.6141803 1.0562784
##   [265] 0.9885941 2.0159368 2.2807809 1.2170619 2.1180172 2.0513803
##   [271] 1.9738968 1.0467716 0.7858885 2.0509416 1.0615704 1.5955862
##   [277] 1.0529387 1.1506385 1.1549604 1.1851678 2.6244584 1.3913328
##   [283] 2.2637513 1.1956142 1.6660635 1.6556590 0.6511588 0.8821809
##   [289] 1.0850688 2.1914395 1.8303015 0.8560444 1.8971200 1.5096548
##   [295] 2.0164056 2.1285739 1.9390009 1.5521265 1.4586564 1.7736403
##   [301] 0.7738864 2.3992129 2.0100600 1.3835207 1.4297802 1.2985768
```

```
## [307] 2.2133983 0.7741945 1.0396394 1.7046055 1.9629775 2.0843139
## [313] 1.4059820 2.3827727 1.7517858 1.5049607 1.4155324 1.3274065
## [319] 1.2724550 2.3491170 2.1194316 1.4790508 0.9932718 1.3587649
## [325] 2.3774976 1.3996710 1.8730734 2.4498838 2.3963573 1.4734232
## [331] 2.3973155 1.5139965 1.3148066 1.5661278 1.1645189 2.2312604
## [337] 0.5729338 1.4343221 1.4956050 1.9633548 1.8780375 2.3554029
## [343] 1.6462556 1.3431831 0.2514396 1.3113334 2.2589549 0.3423617
## [349] 0.9226531 0.5025783 0.8075258 0.8947637 1.2491107 1.4599053
## [355] 2.3118181 0.8041857 0.7381318 1.4919419 1.4416918 1.4434641
## [361] 0.8818594 1.9652050 1.9759203 2.0268103 2.0978515 1.5735991
## [367] 1.0493470 1.4269293 1.8407367 1.5220338 2.1034077 2.2418570
## [373] 1.1678852 1.5574873 1.7956542 1.6120125 2.3169283 0.7501744
## [379] 1.1227454 1.7440792 0.9305983 0.4741435 1.2473510 1.7970183
## [385] 1.0928608 1.9692325 1.8056905 2.3719419 1.8498505 2.0957958
## [391] 1.4071473 1.4695826 2.5071177 1.2725706 1.0823103 2.0143950
## [397] 1.6521098 2.2245009 2.1590470 1.1192421 1.2642171 1.4127939
## [403] 0.9777628 2.7362646 0.6476119 1.6225857 2.4174064 1.8933941
## [409] 0.9176892 1.6551837 2.0687180 0.8218426 0.9330702 1.2979543
## [415] 1.4063175 1.3251590 0.4577364 1.6577057 0.9791962 0.9540158
## [421] 1.4004813 1.1801459 1.3884698 1.8857426 1.1544788 1.8660959
## [427] 1.1807283 0.9338352 1.5739399 1.0326099 0.4930381 1.7098539
## [433] 1.6334179 1.8384113 1.3418156 1.7225680 2.0698326 1.9832152
## [439] 1.3814464 0.3654276 0.9023274 0.8732704 1.8902947 1.4786792
## [445] 1.8600914 1.6257099 1.6617250 0.8831432 0.9766268 1.3487607
## [451] 1.8847255 1.3973673 1.2168437 1.7145176 2.0427892 1.8802533
## [457] 1.9515078 1.0251648 1.0872009 1.1733607 1.8139957 1.1284756
## [463] 0.4365671 1.5709400 2.3335978 2.3372136 1.1981057 1.9011335
## [469] 1.1211382 2.4976260 1.4964291 1.6422707 1.9060107 2.2063039
## [475] 0.6036738 2.0969015 1.9854885 1.1007003 1.7884863 1.5325296
## [481] 1.3839424 1.8925672 1.8573474 1.1996631 1.2468143 1.8506976
## [487] 2.0372384 1.9986691 1.0104894 0.8852565 0.7414027 2.5570679
## [493] 1.5655562 2.0087791 0.2948328 2.2492171 2.1407561 2.2055777
## [499] 1.7504061 1.7628607 2.0866188 1.9745432 0.6271776 0.3192102
## [505] 1.8242319 1.0370245 1.9991788 1.3208102 1.9817568 2.3903293
## [511] 1.9643607 1.0747230 1.4168439 1.8812598 1.3511846 1.7721836
## [517] 1.8838556 2.0049604 0.9775661 2.2882922 1.0276472 1.6699625
## [523] 0.3512928 1.4372301 1.8087001 0.1242795 1.0948163 1.0034185
## [529] 1.7576813 2.3086705 0.3408662 1.9740347 1.7104573 0.9330878
## [535] 2.1603641 1.5087961 1.1304695 1.6890737 1.8983147 1.6971506
## [541] 1.7257077 1.3790773 0.7667191 0.8104604 1.4386476 0.6237508
## [547] 2.0482472 1.9060491 1.5785497 1.2630592 0.7940137 0.8810618
## [553] 1.4468829 1.5417013 1.5692367 1.2103529 1.2793019 2.4068170
## [559] 0.7993712 1.0634396 1.5744949 1.5177914 1.9666061 1.9562960
## [565] 1.6088159 1.2026457 2.0193262 1.2713788 1.8518699 1.1871784
## [571] 0.6834512 2.0081867 1.5591081 1.9356705 1.2314452 1.6568074
## [577] 2.2992591 2.1518548 2.1368470 0.7077774 1.5914250 1.5657352
## [583] 1.9865683 1.4226888 1.3654789 1.9692551 0.8682060 1.9958587
## [589] 1.3724824 1.4858139 0.7546184 2.2514910 2.2071810 0.9644684
## [595] 1.2453088 1.8818691 1.3589289 1.4920353 1.5495642 0.3860565
## [601] 1.3733449 1.5948729 0.8663480 0.9537512 1.6677325 1.2146265
## [607] 1.9237544 0.9554848 1.1606201 2.1907520 0.5014799 0.9069697
## [613] 1.2543151 2.4051906 1.6949793 1.6904564 1.5357317 0.7042999
## [619] 1.0200101 0.8468275 1.5068782 1.7597784 1.6179340 2.2861128
## [625] 1.8244252 1.5108414 0.6538374 2.0122952 2.6414797 1.3294347
```

```
## [631] 1.4000022 1.0882062 1.8799525 1.0867952 1.3788835 1.9231062
## [637] 0.3693664 1.4707787 1.9340455 2.0508740 1.6358488 1.1765430
## [643] 1.9410150 1.5516304 0.3510514 1.1190188 2.1173340 0.8871752
## [649] 1.1551821 2.1585378 1.8949119 1.9107142 1.0221867 1.5526139
## [655] 1.6153279 1.9704697 2.3020092 1.5834465 2.0236970 1.5288390
## [661] 1.6537405 1.3965306 1.0938515 0.8813390 1.5740467 1.4904243
## [667] 1.9923078 1.5210562 1.9643357 1.3835854 0.9705634 1.2973449
## [673] 1.3569147 1.2583330 1.8367807 1.5597976 0.7894823 1.3975216
## [679] 1.2903893 0.9832160 1.0392579 1.3410693 1.9809441 1.4008493
## [685] 1.1232840 1.1082151 2.1231623 1.1749509 1.3945048 1.7122544
## [691] 1.4693449 1.2152025 1.9803376 2.2042245 2.2163395 1.1120309
## [697] 2.4035182 2.3107187 1.6441065 1.9493991 0.9389201 0.8381184
## [703] 1.9891565 1.4764676 2.4520692 1.0274279 1.3668308 1.3894223
## [709] 2.3237423 2.1577947 1.4280600 1.9595075 0.9591655 1.1305743
## [715] 2.0397770 2.1708598 0.4834797 1.3570759 2.1261162 0.9438940
## [721] 1.4806114 2.3556972 1.3643358 1.8504349 1.0739491 1.5198717
## [727] 1.9014550 1.0027910 0.9096267 1.9320853 1.6199550 1.0957867
## [733] 1.3975789 1.6886097 2.5064418 1.1233464 1.7853558 0.9872825
## [739] 1.0086748 1.1243121 1.5952976 2.0347346 1.2926955 2.3019448
## [745] 0.6917162 2.5424841 1.7389744 1.6442479 1.3856710 1.4959261
## [751] 2.0368083 1.3906388 1.2456808 1.1674379 2.1073789 1.3832482
## [757] 1.0225996 1.3179373 2.0829154 1.1317012 0.7923381 1.5194952
## [763] 1.2054829 1.2973055 1.5511501 1.7463914 2.4008339 0.7643940
## [769] 2.0407276 1.3182892 1.4735221 2.0193821 1.5723585 1.2561234
## [775] 1.8912032 2.2238231 0.6498995 0.9006483 1.3352752 1.7481944
## [781] 0.9624088 1.3063531 1.1337181 1.3879896 1.7203917 1.3302103
## [787] 1.6782454 1.7331169 1.8253723 1.7227276 1.3052090 2.3534125
## [793] 1.3450246 0.9905391 0.7628997 1.7804820 0.5933246 1.3102030
## [799] 2.0419228 1.6724680 1.8336907 2.2167114 1.6334929 1.7372035
## [805] 1.9739628 0.4693979 2.2512826 1.4750924 1.3418824 1.4079282
## [811] 1.6378949 1.8228059 0.7118786 2.0278540 1.5021228 2.1184362
## [817] 1.4887189 1.8182172 2.0296746 1.9799853 0.7474353 0.9382379
## [823] 2.5311640 1.9573912 1.7597676 1.5511384 1.3190917 1.5963018
## [829] 1.2842543 0.7745569 1.6826256 1.9496693 0.6111317 1.8270779
## [835] 1.6847484 2.0602276 1.1363709 1.9125487 1.8831311 1.8796326
## [841] 1.3213147 1.3305746 1.2495996 1.3925033 2.0038406 1.2528909
## [847] 2.1682764 1.9600022 1.3985505 0.8690901 1.6086680 2.1785549
## [853] 2.2900696 1.4926917 1.7598847 1.0177165 1.5138819 1.4587450
## [859] 1.1541424 1.1166251 1.1182997 1.6894099 1.0087974 1.3364398
## [865] 1.8140421 1.5017925 1.5085624 2.3498170 1.1450991 1.9054448
## [871] 1.5163737 1.6945332 1.7541436 1.8045614 2.0121120 1.3642405
## [877] 2.5402028 1.9053174 1.9429658 2.0742747 1.8235136 0.7804201
## [883] 0.6999373 2.0801068 2.0461595 1.1629223 0.9573869 0.6467191
## [889] 2.1740417 1.0894431 2.3623946 1.9902535 0.8207860 1.7794324
## [895] 1.2139835 1.9956383 0.6399554 1.6126737 1.9670308 2.4226984
## [901] 1.0613408 1.7776094 1.3485490 2.1654616 1.2316518 1.0871317
## [907] 0.5867901 1.6661996 1.5863471 1.6226346 0.6773969 1.5065357
## [913] 1.2320665 1.3672621 1.3484381 1.9113560 1.5175421 0.8184507
## [919] 1.2114734 0.1908558 1.1409597 1.8361772 0.9791451 2.2150625
## [925] 1.6123736 1.0302720 1.5954908 1.9579006 1.9912401 1.3054951
## [931] 1.9113410 1.2693290 1.3443411 1.3282099 2.1179190 1.8293512
## [937] 1.3386400 0.9063717 1.6995914 1.5380685 1.1208200 1.4611655
## [943] 2.0319065 1.4251982 1.7012846 0.4671441 1.2808201 2.2697046
## [949] 1.5606469 1.9939058 1.4730339 1.4327477 1.1518971 2.5998698
```

```
## [955] 1.5709636 1.1177088 1.7593236 1.5684855 2.4566313 2.2754021
## [961] 2.4103893 0.9885620 1.5795832 1.4155031 0.8163728 1.1699269
## [967] 0.5779311 1.2328869 1.5369924 1.0627837 1.7231069 2.6351391
## [973] 2.0040667 2.0912254 1.6171342 1.1589420 1.9425270 2.0617612
## [979] 0.6291526 1.9096765 1.7918419 1.5069333 1.9571272 1.1080165
## [985] 1.7306663 1.7433508 0.4396424 1.7696877 0.8089792 0.8842047
## [991] 1.2286641 1.6012910 0.6557672 1.2090026 1.3730994 2.2070858
## [997] 0.5897846 1.4722966 1.1392915 1.6441776
```

```r
Y = colSums(data_mat[3:5,]) # Y = X3 + X4 + X5
Y
```

```
##   [1] 1.2061947 1.5069344 1.5052900 1.3759910 0.8312619 1.8269623
##   [7] 1.6518335 1.0486138 1.4100710 1.1680148 1.2509977 1.4153129
##  [13] 2.1902371 1.7291983 1.9832314 0.6424357 1.6520820 1.7367434
##  [19] 1.7582243 1.3621749 1.8417388 1.2980633 1.1396211 1.1934696
##  [25] 1.5273372 1.9223719 1.8294398 1.5271612 1.7268431 1.1265333
##  [31] 1.6604502 1.9333005 1.9373772 2.0960373 1.5974552 2.1133975
##  [37] 1.1435253 2.1450463 1.8923299 1.6655496 1.9396473 0.8488723
##  [43] 1.7346482 1.9994342 1.8359640 1.2882657 1.9519404 0.9188064
##  [49] 1.6292730 1.0709367 2.3098977 1.3321045 1.5564568 0.9231782
##  [55] 0.3000196 1.7680415 1.3086552 2.0628415 1.4921395 1.3480737
##  [61] 1.3204938 2.0693955 1.1565193 1.2012182 1.5058105 1.8191495
##  [67] 1.8200862 0.5011427 1.5572886 1.2505617 2.0710458 1.8887219
##  [73] 0.9853364 0.9715976 2.0759458 1.3089152 0.7717384 1.5301724
##  [79] 2.1101799 1.3832016 0.4594584 2.3867338 1.2987333 1.4420519
##  [85] 1.2924705 1.5146397 1.7716354 1.4145760 1.4822384 2.0548728
##  [91] 2.3915331 1.8221350 0.6387030 2.0600952 1.3123944 2.5064180
##  [97] 1.1278592 1.6653095 1.7318864 1.5003700 1.6330343 2.0116064
## [103] 1.6672822 1.5740589 1.4328037 0.5493236 1.0680033 2.0410347
## [109] 0.4911720 1.6371411 1.9152931 1.1446402 1.2772202 1.8677054
## [115] 2.1085250 1.8685679 0.9650497 1.4103578 0.8114939 2.1622747
## [121] 1.4291566 0.3944848 1.5801048 2.4466224 0.3657680 1.9005750
## [127] 1.0746543 0.9750356 1.5978501 2.2400063 1.2499242 1.8332928
## [133] 1.0113406 1.4508350 1.7121479 1.6677413 1.5424277 1.1387213
## [139] 2.3464002 2.2361938 2.4082409 0.9246100 2.0837861 1.7131631
## [145] 1.6243552 1.3423312 0.7715715 1.7432286 0.5454006 2.2636900
## [151] 0.7317233 0.7629876 1.9962627 0.5204223 1.2246215 2.4601521
## [157] 0.8111048 1.3241214 0.8333706 1.1789003 2.1943284 1.2163980
## [163] 1.5837901 2.1139026 1.3421784 1.1637872 1.4495916 1.4008875
## [169] 1.9007503 2.3048910 0.6995260 1.5969229 1.5327389 0.9123689
## [175] 0.9832796 1.3736225 1.9331989 0.9581260 2.3164518 1.1492557
## [181] 0.8716314 1.7097383 0.6518901 0.9029408 1.5055867 1.9264557
## [187] 1.5351735 0.9668773 0.6896812 1.1651106 1.8713432 1.5855229
## [193] 1.4792799 1.1803540 1.7312818 2.2703236 1.6380601 1.6414123
## [199] 1.2801690 2.0689203 1.5762699 1.0365934 1.2631190 1.9487682
## [205] 0.8892401 1.9402219 1.2399000 1.5609169 1.5285953 1.4896757
## [211] 0.6674240 0.8736726 0.7875625 1.5137536 2.1672033 1.8828470
## [217] 0.9999035 1.8605443 1.5201692 2.2572101 0.3300987 1.1215677
## [223] 2.4922035 0.9850347 1.7448132 1.6932974 2.2140829 0.6156001
## [229] 1.0344115 1.6319058 1.4078369 1.7284315 0.1725387 2.3309996
## [235] 1.3578950 1.8792708 2.1217332 1.1112881 0.9686110 1.0613587
## [241] 1.2829883 2.1276041 2.7100811 1.6283136 1.3106922 1.5906329
## [247] 2.2534935 1.7560027 1.5290718 1.9006901 0.3641103 2.1846413
## [253] 1.1556904 1.4441362 0.6351856 0.9524326 1.2626451 1.3816062
```

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##  [259] 1.1242139 0.5123533 1.7400840 1.4237869 1.3972130 1.2224823
##  [265] 1.1895359 1.7358097 2.1661262 0.9212345 1.9581786 1.3228786
##  [271] 1.4175615 0.8230992 1.1597276 2.4606431 1.1442018 1.8626800
##  [277] 1.0079818 2.3490056 1.9854486 1.4154783 1.2186993 2.2120947
##  [283] 1.7688592 0.4652323 1.6626407 1.7911588 1.3007841 0.4978776
##  [289] 1.2271247 1.9551089 1.7567420 1.1409043 1.1563966 0.8393539
##  [295] 1.2540961 1.3663824 0.9317896 1.8367374 1.5734623 2.5173596
##  [301] 1.5366060 2.3505382 1.4775793 1.9226009 1.1448558 1.2808394
##  [307] 1.0271291 0.9087497 2.6055007 2.0568991 2.1814979 1.8820401
##  [313] 1.7890158 1.6547786 1.4860176 2.1012254 0.8246602 1.0796403
##  [319] 0.8575175 1.4376390 1.7794443 1.9940750 2.5652390 1.6773410
##  [325] 2.0718939 1.3186940 1.2984853 2.2160985 1.4379735 1.6539048
##  [331] 1.6272894 1.2998447 1.6422636 1.1418714 1.2309171 0.8923614
##  [337] 0.2888134 1.3602667 1.0573285 1.3382190 1.5066064 2.1908398
##  [343] 0.8491452 1.5375217 1.4510316 0.2692394 1.5721309 1.8148700
##  [349] 1.5533366 0.8014084 1.5652094 1.8587939 1.5865715 1.3682252
##  [355] 2.4873951 1.2841218 0.4010731 1.2156268 1.1588132 1.4391197
##  [361] 1.1800339 1.5435193 1.5783074 2.2105567 1.7856485 1.5982021
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##  [391] 1.1170067 1.7817338 2.0164337 1.8628532 1.5874352 1.2487865
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##  [415] 1.4851657 1.3961760 1.0516689 0.4698659 1.8061842 0.9894503
##  [421] 1.0927988 1.5639788 1.8694705 2.1605565 1.1437818 1.4284672
##  [427] 1.8772974 1.3232724 1.3051075 0.8971936 1.9384289 2.1741370
##  [433] 1.0834075 1.4507078 1.4463730 1.1838258 1.3033610 2.7740236
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##  [445] 0.7300157 1.2103929 1.9063139 1.9353322 1.0230006 1.2078151
##  [451] 1.6427220 1.2377774 1.9945667 1.6825521 2.2341055 2.3887398
##  [457] 1.9951104 0.9832248 1.2947617 1.7930229 0.6158099 1.1022952
##  [463] 0.7654567 2.3205652 1.7339876 1.3884871 1.5986471 1.6352598
##  [469] 0.5560179 1.9055308 1.0001373 1.2750396 1.9103299 2.2584096
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##  [487] 1.3860057 2.1686877 0.5567999 1.5567570 0.6655870 1.9677527
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##  [505] 1.3370796 1.9577834 1.4829736 0.5120323 1.7591175 2.4190665
##  [511] 1.6574170 1.3753801 1.7024015 1.0133995 0.9387511 1.9875183
##  [517] 2.2481923 1.0815095 2.2205827 1.2401204 1.0970850 1.8584782
##  [523] 0.8029180 1.6894946 2.0851629 0.3801074 1.6639047 0.4371674
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##  [541] 2.0981447 1.5686739 1.6492592 2.1773650 1.8298560 1.4857279
##  [547] 1.0190758 0.7646560 1.6019423 1.1891004 1.8204562 0.5001810
##  [553] 1.6921053 1.7149506 0.8506489 1.1441907 1.4173015 1.2554104
##  [559] 1.2005473 1.1941577 1.8073345 1.2178519 2.1116853 1.8213185
##  [565] 1.3123555 1.3567240 1.8250125 0.8921809 2.3177299 1.5246413
##  [571] 1.7489770 1.4075011 0.7703841 1.0127442 1.8535147 1.4261643
##  [577] 1.5846318 2.5900428 1.0771229 1.5595163 2.2725695 1.4926586
```

```
## [583] 2.0380773 1.5366282 1.9653167 2.0513634 1.1142200 2.0894823
## [589] 1.1399954 1.5849677 2.2718129 1.6618985 1.2871298 0.8361518
## [595] 1.3568856 2.4104852 0.7958748 1.6892583 1.2557485 1.1584169
## [601] 1.0524845 0.9290742 1.5187060 1.0023441 2.1512034 1.8562063
## [607] 1.6486640 1.2614803 0.6758935 1.4726204 1.3228898 1.3391530
## [613] 1.6240844 1.6988040 1.3749858 1.4914109 1.0882714 1.0352979
## [619] 2.2822776 1.2727495 2.1062215 2.2721082 1.6817020 1.1954280
## [625] 0.5190683 1.3797189 1.5876244 1.5343719 2.2924131 1.8156640
## [631] 1.1573395 2.2409241 2.3035585 1.3443295 1.4593360 2.4741250
## [637] 1.2719148 1.3260756 1.3721847 0.4682981 1.3148465 1.2450868
## [643] 1.3956101 1.3428900 2.2420893 1.3492529 2.4810784 1.4341645
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## [655] 1.8076107 1.2327302 1.8385786 1.3775181 1.9798101 2.0391597
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## [691] 1.2152227 1.3946411 2.2947473 2.2495198 2.1956630 1.3177095
## [697] 1.9743692 1.6083356 1.3249863 1.1985752 0.8430365 1.5145785
## [703] 1.7301008 1.2378077 2.4701784 1.4838683 0.9321400 1.7497874
## [709] 1.2030200 2.1310151 1.7076595 1.4132255 0.9148855 2.1432740
## [715] 1.5650053 1.0222330 1.0273644 1.9547711 1.8948242 0.6094456
## [721] 1.3450507 1.7102371 2.0526477 1.8049989 1.7483303 1.2549433
## [727] 1.3046207 0.7428962 1.4388776 0.7528834 1.7108102 1.0971521
## [733] 0.9736003 1.4842236 2.5578697 1.3861679 1.0010307 1.9650963
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## [769] 2.4930900 2.2790448 1.1803196 1.4510512 1.5987042 2.2005501
## [775] 1.6202532 1.1576646 1.3326303 1.7169514 1.1321457 1.6157688
## [781] 1.9766085 1.9206578 1.0381822 1.4599697 2.2242144 0.7765336
## [787] 2.5331138 2.3047696 1.6831852 1.2141533 2.1120679 2.3395080
## [793] 1.5806125 1.2430970 1.7479760 2.3072725 1.2282361 0.4370846
## [799] 1.2219764 1.8259850 1.9159023 1.5041113 2.0125762 1.5804809
## [805] 1.8395207 0.2752067 1.2926556 0.8803299 2.0996912 1.3204734
## [811] 0.9958224 2.0443991 1.0766745 1.4269152 1.5712463 1.8679014
## [817] 0.9214110 1.9008554 1.9161874 1.7358217 1.0555118 1.1920122
## [823] 1.4101359 1.3160870 1.0764683 1.3983997 1.2494178 1.8847675
## [829] 1.5713192 1.2758008 1.7213537 1.3174892 1.5657259 2.1142009
## [835] 1.2936899 1.8148417 2.0413045 2.4145464 2.2572988 1.0445604
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## [847] 1.3314417 1.9679670 1.5656623 1.9474992 2.5636929 1.7454797
## [853] 1.6074408 1.6207368 0.9230890 1.7567909 1.5455714 1.3291741
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## [895] 1.5400781 1.6848791 1.5681042 1.8890485 1.1478173 2.4038829
## [901] 1.6083714 1.6935428 0.9857931 1.1206708 2.0530851 1.7705129
```

```
##  [907] 0.3212688 1.5961823 2.2886935 1.4538728 1.2423770 2.1365947
##  [913] 1.6323643 0.8807173 0.9956427 0.9435923 2.2389400 1.2419359
##  [919] 1.0039023 1.6661127 1.9392279 1.8951981 1.1055749 1.1571361
##  [925] 1.3938571 1.6227917 1.5031770 0.8698659 1.3961317 1.8498287
##  [931] 2.2026971 1.1324852 1.6505418 2.6205729 1.2248480 2.0529877
##  [937] 1.5752528 1.0906486 1.3183532 2.0593458 0.7805507 1.0456712
##  [943] 1.4517990 1.5603722 1.4592631 2.1202139 0.9104873 0.5646611
##  [949] 2.3224176 1.5738108 1.9055685 1.5889479 1.6455938 2.6011150
##  [955] 1.7133882 1.9151635 0.9215774 2.2556139 1.4476521 1.8467505
##  [961] 1.6925628 0.6287624 2.0865583 1.6699262 1.8384691 0.7134765
##  [967] 0.5041715 1.7270229 1.1926398 1.3911053 1.6361272 1.8870651
##  [973] 1.4733800 1.1890326 1.1658473 2.1625502 2.1898523 1.7323583
##  [979] 0.5295468 1.4633888 0.7777446 2.0709614 1.8228386 0.6325395
##  [985] 1.6962940 1.6189199 1.1750836 1.4663560 1.0325927 0.8079933
##  [991] 1.3688477 1.6318939 0.6212362 2.0262398 1.8317023 1.0242051
##  [997] 1.9367936 0.6244542 1.2752383 1.2836667
```

```r
cat("Covariance of X and Y = ", cov(X,Y))
```

```
## Covariance of X and Y =  0.07977232
```

Question No 2

The random variable X takes values -1, 0, 1 with probabilities 1/8, 2/8, 5/8 respectively. (a) Compute E(X). (b) Given the pmf of Y = X2 and use it to compute E(Y). (c) Instead, compute E(X2) directly from an extended table. (d) Compute Var(X).

```r
# Given:
X = c(-1, 0, 1)
X
```

```
## [1] -1  0  1
```

```r
Probability_X = c(1/8, 2/8, 5/8)
Probability_X
```

```
## [1] 0.125 0.250 0.625
```

```r
X_squared = X*X
Y = X_squared
X_squared
```

```
## [1] 1 0 1
```

```r
#(a) Compute E(X).
Expected_X = sum(X * Probability_X)
cat("Expected Value of X = E(X) = ", Expected_X)
```

```
## Expected Value of X = E(X) =  0.5
```

```r
#(b) Given the pmf of Y = X2 and use it to compute E(Y).
#(c) Instead, compute E(X2) directly from an extended table.
Expected_X_squared = sum(X_squared * Probability_X)
cat("Expected value of X_squared = E(X_squared) = ", Expected_X_squared)
```

```
## Expected value of X_squared = E(X_squared) =  0.75
```

```r
cat("Expected Value of Y = E(Y) = \n", Expected_X_squared)
```

```
## Expected Value of Y = E(Y) =
##  0.75
```

```r
# (d) Compute Var(X).
variance1_X = sum(((X - Expected_X)^2)*Probability_X) # by theoretical formula
cat("By theoretical formula, Variance of X = Var(X) = ", variance1_X)
```

```
## By theoretical formula, Variance of X = Var(X) =  0.5
```

```r
variance2_X = Expected_X_squared - (Expected_X ^ 2) # by computational formula
cat("By computational formula, Variance of X = Var(X) = ", variance2_X)
```

```
## By computational formula, Variance of X = Var(X) =  0.5
```