> m1 <- c(0,1/3,1/3,1/3)

> m2 <- c(0,0,1/2,1/2)

> m3 <- c(1,0,0,0)

> m4 <- c(1/2,0,1/2,0)

> M <- cbind(m1,m2,m3,m4)

> p1 <- c(0,0,0,0)

> p2 <- c(0,1,0,0)

> P <- cbind(p1,p2)

> T <- 2

> while (sum(abs(P[,T]-P[,T-1])) > 0.001) {

+ P <- cbind(P,rep(0,4))

+ P[,T+1] <- M%\*%P[,T]

+ T <- T + 1

+ }

> P[,T]

[1] 0.3870925 0.1289665 0.2903766 0.1935643

> sum(P[,T])

[1] 1

> ind <- 1:1000

> T <- 2

> M <- matrix(rep(0,1000^2), nrow=1000, ncol=1000)

> for (i in 1:1000) {

+ a <- sample(x=1:10, size=1)

+ b <- sample(x=1:1000, size=a)

+ M[b,i] = 1/a

+ P <- matrix(rep(0,1000), nrow=1000, ncol=2)

+ P[2,2] <- 1

+ }

> fun <- function(M) {

+ while (sum(abs(P[,T]-P[,T-1])) > 0.001) {

+ P <- cbind(P,rep(0,1000))

+ P[,T+1] <- M%\*%P[,T]

+ T <- T + 1

+ }

+ return(P[,T])

+ }

> fun(M)

[1] 1.327534e-03 1.040887e-03 8.548241e-04 6.461921e-04 1.036526e-03 2.316998e-03 1.218377e-03

[8] 1.920814e-03 4.748565e-04 1.253934e-03 1.098874e-03 5.497502e-04 8.438737e-04 1.054219e-04

[15] 1.081718e-03 5.114882e-04 2.451736e-04 8.550690e-04 4.006636e-04 3.305302e-04 9.147051e-04

[22] 1.078728e-03 3.110234e-04 1.890102e-04 6.718690e-04 7.843387e-04 1.198048e-03 9.532668e-04

[29] 8.749224e-04 5.411105e-04 1.363085e-03 1.433895e-03 1.171152e-04 1.048359e-03 8.620544e-04

[36] 7.517372e-04 1.543156e-04 1.000283e-03 1.058331e-03 1.037047e-03 5.718931e-04 6.925196e-04

[43] 2.381261e-04 7.499025e-04 1.216222e-03 7.473771e-04 1.375945e-03 7.175290e-04 1.362882e-03

[50] 1.274700e-03 4.496620e-04 9.380625e-04 1.795206e-04 4.306639e-04 1.097570e-03 4.221456e-04

[57] 6.461867e-04 7.680591e-04 7.133971e-04 5.023084e-04 9.230191e-04 9.858088e-04 1.150913e-03

[64] 1.317949e-03 1.667948e-03 3.543376e-04 3.248039e-04 3.795467e-04 6.634802e-04 1.182790e-03

[71] 1.201259e-03 1.072028e-03 3.932887e-04 1.193944e-03 7.636860e-04 1.431012e-03 9.448704e-04

[78] 5.979823e-04 1.767037e-03 8.530286e-04 6.336040e-04 2.107270e-03 9.252487e-04 1.090892e-03

[85] 1.794908e-03 1.030289e-03 3.588023e-04 1.143267e-03 1.414450e-03 1.425894e-03 6.685286e-04

[92] 1.159610e-03 8.560128e-04 2.032476e-03 6.516927e-04 9.695078e-05 1.218216e-04 9.815414e-04

[99] 4.137729e-04 1.439278e-03 1.540219e-03 1.470298e-03 8.123175e-05 1.179666e-03 2.652370e-03

[106] 2.097406e-03 2.385868e-03 4.392766e-04 6.117425e-04 2.583217e-04 1.330819e-03 6.221901e-04

[113] 2.116060e-03 1.229575e-03 3.278954e-04 8.798824e-04 9.872477e-04 3.864154e-04 1.916312e-03

[120] 7.218546e-04 5.569891e-04 9.624835e-04 4.974689e-04 1.017387e-03 6.953961e-04 2.795509e-03

[127] 7.620597e-04 4.163251e-04 1.352552e-03 1.763058e-03 1.019254e-03 1.017903e-03 2.298438e-03

[134] 1.220647e-03 3.036167e-04 1.123662e-03 8.516428e-04 1.568999e-03 1.098105e-03 9.802031e-04

[141] 1.020823e-03 8.199728e-04 1.074629e-03 1.324484e-03 1.202565e-03 4.202482e-04 3.062039e-03

[148] 1.933191e-03 6.139252e-04 1.191686e-03 1.233165e-03 4.289756e-04 1.340915e-03 1.129546e-03

[155] 9.702178e-04 8.989606e-04 3.531827e-04 6.840619e-04 1.729713e-03 1.589198e-03 2.435306e-04

[162] 6.383946e-04 1.500381e-03 5.127389e-04 1.150831e-03 0.000000e+00 3.885092e-04 1.105509e-03

[169] 4.308492e-04 1.324017e-03 8.430234e-04 1.403350e-03 7.296945e-04 9.223738e-04 3.854588e-04

[176] 1.540543e-03 1.655290e-04 9.974986e-04 3.484573e-04 8.098533e-04 8.113591e-04 4.259217e-04

[183] 1.808789e-03 4.619355e-04 8.439286e-04 7.183981e-04 1.837007e-03 1.456198e-03 4.934241e-04

[190] 1.395916e-03 9.552105e-04 1.248452e-03 9.680482e-04 4.922414e-04 6.369712e-04 2.206945e-03

[197] 2.497504e-04 8.439035e-04 1.422869e-03 1.701251e-03 8.893850e-04 2.010307e-04 7.565790e-04

[204] 9.813137e-04 1.225468e-03 1.636925e-03 1.172175e-03 4.208336e-04 6.529759e-04 2.181990e-03

[211] 7.980359e-04 8.645296e-04 1.741067e-03 6.411619e-04 6.639914e-04 7.680556e-04 1.469647e-03

[218] 2.780326e-03 9.658557e-04 2.360967e-03 5.878437e-04 1.883518e-03 7.974149e-04 7.445074e-04

[225] 1.685304e-03 1.161534e-03 1.793129e-03 3.631226e-04 1.231343e-03 1.242195e-03 6.049753e-04

[232] 6.889795e-04 8.116013e-04 8.647440e-04 8.268378e-04 1.233780e-03 2.054759e-03 6.853405e-04

[239] 4.398908e-03 5.981032e-04 7.742085e-04 3.151995e-04 7.317474e-04 1.344827e-03 1.660007e-03

[246] 1.420604e-03 1.344860e-03 1.077658e-03 1.360723e-03 5.857690e-04 7.960231e-04 6.933221e-04

[253] 1.865870e-03 4.712652e-04 7.882844e-04 1.615614e-03 6.853292e-04 4.240366e-04 6.510420e-04

[260] 8.679663e-04 4.988640e-04 3.510380e-04 9.950775e-04 1.463171e-03 1.836206e-03 3.475047e-04

[267] 1.091838e-03 9.247822e-04 4.083262e-04 1.655627e-03 1.719440e-03 1.184963e-03 4.826084e-04

[274] 9.168079e-04 5.737322e-04 1.069964e-03 1.965777e-03 7.376374e-04 8.171126e-04 1.248657e-03

[281] 1.249297e-03 8.807749e-04 4.664759e-04 1.167311e-03 7.619955e-04 1.001283e-03 3.957090e-04

[288] 2.375809e-04 4.413599e-04 7.570471e-04 7.861800e-04 8.229976e-04 7.167221e-04 2.647622e-03

[295] 1.041525e-03 1.147323e-03 2.664465e-04 1.209050e-03 6.352765e-04 1.043946e-03 4.145504e-04

[302] 7.865293e-04 1.372026e-04 7.811340e-04 1.428700e-03 7.146892e-04 1.883584e-03 5.639041e-04

[309] 1.085817e-03 1.359718e-03 5.899491e-04 1.111357e-03 1.170487e-03 9.432285e-04 3.966691e-04

[316] 1.489288e-03 1.077538e-03 6.905253e-04 1.481774e-03 2.677167e-03 1.715922e-03 5.810528e-04

[323] 1.830619e-03 5.839009e-04 8.199369e-04 5.142871e-04 3.666665e-04 4.954583e-04 1.051546e-03

[330] 1.471430e-03 1.230803e-03 1.365133e-03 8.141058e-04 1.694365e-03 1.037589e-03 7.490152e-04

[337] 1.574488e-03 5.203139e-04 7.626493e-04 1.017137e-03 1.640434e-03 8.721714e-04 8.874265e-04

[344] 9.586132e-04 3.928467e-04 1.352672e-04 3.418370e-04 6.230139e-04 6.853606e-04 5.024974e-04

[351] 3.786670e-04 1.966992e-03 4.697440e-04 1.874731e-03 1.160579e-03 9.633477e-04 7.115570e-04

[358] 9.658683e-04 1.057751e-03 1.303353e-03 1.029582e-03 4.677711e-04 1.827049e-03 2.332653e-03

[365] 2.572685e-04 8.017964e-04 8.132712e-04 1.489913e-03 1.318904e-03 2.390739e-03 4.256652e-04

[372] 2.842786e-03 7.084142e-04 8.431232e-04 1.062584e-03 1.659991e-04 6.938261e-04 3.497748e-04

[379] 8.080623e-04 1.374598e-03 7.975666e-04 8.377227e-04 2.194147e-04 4.044812e-04 7.905276e-04

[386] 5.454728e-04 2.419065e-03 7.958883e-04 1.501870e-03 9.377890e-04 1.783049e-03 1.455143e-03

[393] 1.185849e-03 1.360853e-03 6.469439e-04 4.643614e-04 2.185424e-04 1.846815e-03 1.256894e-03

[400] 1.100833e-03 5.830240e-04 6.653532e-04 5.093794e-04 9.755861e-04 1.652536e-03 6.868465e-04

[407] 7.441211e-04 4.666438e-04 1.626521e-04 1.410772e-03 5.272252e-04 1.739575e-03 1.160154e-03

[414] 6.281526e-04 4.418009e-04 2.247986e-03 8.997660e-04 7.517037e-04 4.632179e-04 1.060163e-03

[421] 6.352230e-04 1.524231e-03 7.152547e-04 4.423191e-04 2.266213e-03 1.276421e-03 1.567537e-03

[428] 1.865414e-03 3.589899e-04 4.875357e-04 1.040949e-03 3.304788e-04 8.124155e-04 8.106740e-05

[435] 1.334693e-04 2.960098e-03 3.237777e-04 1.445495e-03 9.720121e-04 1.377803e-03 1.762799e-03

[442] 3.219612e-04 6.411406e-04 1.237971e-03 1.115099e-04 5.367395e-04 7.968292e-04 6.722186e-04

[449] 1.450995e-03 1.981651e-03 2.582470e-03 5.037979e-04 2.148413e-03 1.811381e-03 1.150457e-03

[456] 4.334450e-04 1.336332e-03 8.395490e-05 1.217332e-03 6.463005e-04 1.646075e-03 1.532685e-03

[463] 1.655290e-04 6.496776e-04 1.750248e-03 1.212536e-03 1.204033e-03 6.609268e-04 9.067034e-04

[470] 2.889787e-04 9.246787e-04 1.004888e-03 9.044599e-04 1.592421e-03 4.947939e-04 1.484955e-03

[477] 1.185309e-03 1.474099e-03 4.659976e-04 4.830138e-04 1.022322e-03 1.076219e-03 1.062358e-03

[484] 6.495559e-04 5.343660e-04 2.196459e-03 1.167286e-03 7.339030e-04 1.137922e-03 1.422905e-03

[491] 1.179671e-03 1.433827e-03 1.537363e-03 1.190975e-03 5.636655e-04 1.195322e-03 1.315796e-03

[498] 9.017876e-04 4.755163e-04 5.811306e-04 1.268397e-03 1.167398e-03 2.715301e-04 1.320603e-03

[505] 3.814441e-04 2.134101e-04 1.030220e-03 2.169281e-04 1.129274e-03 1.846867e-03 2.585052e-03

[512] 2.680804e-03 1.016419e-03 1.963358e-03 7.561304e-04 1.360871e-03 1.318461e-03 3.894292e-04

[519] 3.512630e-04 1.232887e-04 1.660744e-04 7.352040e-04 4.156556e-04 7.404264e-04 6.988873e-04

[526] 2.503901e-03 8.122363e-04 9.510905e-04 4.655810e-04 6.957620e-04 8.750226e-04 5.800089e-04

[533] 1.589472e-03 7.065018e-04 9.505109e-04 7.704965e-04 3.727693e-04 2.549366e-03 1.236295e-03

[540] 2.362817e-03 1.719358e-03 4.798832e-04 8.712264e-04 6.350789e-04 7.471973e-04 2.078152e-03

[547] 6.241395e-04 1.743366e-03 9.583714e-04 1.643575e-03 3.877451e-04 1.262609e-03 1.722392e-03

[554] 1.129188e-03 7.164377e-04 4.830355e-04 1.156068e-03 5.097661e-04 5.065376e-04 1.119729e-03

[561] 9.909980e-04 4.247294e-04 2.225397e-03 9.113816e-04 2.524539e-04 1.124951e-03 6.733605e-04

[568] 1.593841e-03 4.786621e-04 5.232374e-04 1.130947e-03 1.252762e-03 3.119701e-04 1.108426e-03

[575] 5.748728e-04 4.045500e-04 1.070383e-03 5.290227e-04 5.684109e-04 1.230510e-03 2.504444e-03

[582] 5.849541e-04 1.421338e-04 5.991260e-04 1.301154e-03 3.619938e-04 5.839120e-04 4.207672e-04

[589] 1.315041e-03 1.336834e-03 1.354961e-03 2.537956e-03 2.196282e-03 3.959253e-04 8.865136e-04

[596] 4.083345e-04 1.570188e-03 1.078553e-03 1.120430e-03 1.797625e-03 1.324819e-03 1.437963e-04

[603] 1.674117e-03 8.729607e-04 8.609285e-04 1.379890e-03 1.876695e-03 6.615064e-04 1.481156e-03

[610] 1.217563e-03 1.832664e-03 3.663364e-04 8.486859e-04 3.524054e-04 9.508112e-04 4.262572e-04

[617] 1.729797e-03 8.127992e-04 8.348561e-04 9.099916e-04 6.535513e-04 4.071092e-04 1.231201e-03

[624] 9.562833e-04 5.255036e-04 1.368798e-03 7.185135e-04 1.563653e-04 7.217020e-04 2.077859e-04

[631] 1.752385e-03 1.090658e-03 2.608211e-04 3.824548e-04 1.659756e-03 5.771331e-04 8.979412e-04

[638] 2.992553e-03 1.664696e-03 7.897257e-04 1.300990e-03 9.704660e-04 8.631507e-04 1.182569e-03

[645] 8.771771e-04 8.316997e-04 5.922157e-04 2.359095e-03 3.907601e-04 7.066993e-04 2.159025e-03

[652] 4.504188e-04 1.757544e-03 2.258839e-03 2.018269e-04 9.154686e-04 3.567108e-04 7.485300e-04

[659] 9.370566e-04 6.496379e-04 8.496266e-04 5.633912e-04 3.441231e-04 7.396316e-04 7.117225e-04

[666] 8.053212e-04 4.497499e-04 1.078531e-03 1.978172e-03 7.563491e-04 1.591141e-03 6.253709e-05

[673] 1.677213e-03 8.653019e-04 9.916542e-04 5.622692e-04 1.187543e-03 5.328022e-04 1.567467e-03

[680] 3.306115e-04 1.463557e-03 2.801771e-04 1.031398e-03 1.147314e-03 3.784551e-04 1.629409e-03

[687] 8.153888e-04 1.227127e-03 5.654031e-04 4.506236e-04 5.072381e-04 7.382612e-04 1.114094e-03

[694] 1.108285e-03 6.916168e-04 9.794120e-04 1.574344e-03 1.466537e-03 1.152682e-03 1.825069e-03

[701] 1.585414e-03 1.384751e-03 1.272576e-03 1.640513e-03 4.328136e-04 1.996266e-03 5.764378e-04

[708] 2.004730e-04 1.917948e-03 1.064996e-03 5.205615e-04 4.141521e-04 3.547492e-04 1.384947e-03

[715] 1.573170e-03 1.777071e-04 5.093585e-05 1.228417e-03 2.585819e-04 4.665978e-04 9.233069e-04

[722] 1.489149e-04 1.042599e-03 1.547176e-03 1.278151e-03 5.396853e-04 5.177772e-04 2.372839e-03

[729] 2.934403e-04 1.847546e-03 7.538858e-04 0.000000e+00 5.109540e-04 4.984998e-04 7.093730e-04

[736] 1.532766e-03 8.111223e-04 4.122411e-04 5.490795e-04 0.000000e+00 5.422339e-04 1.242029e-03

[743] 1.021503e-03 6.190528e-04 1.328097e-03 6.192696e-04 1.175145e-03 1.582806e-03 1.733392e-03

[750] 3.486284e-04 7.305097e-04 1.448440e-03 3.653236e-04 6.218073e-04 1.179848e-03 3.221296e-04

[757] 2.621809e-03 8.735748e-04 1.255135e-03 1.127723e-03 1.005291e-04 4.900191e-04 9.031286e-04

[764] 1.282659e-03 3.340709e-03 1.995544e-04 4.164186e-04 1.049250e-03 1.168302e-03 6.954534e-04

[771] 3.538097e-03 8.165203e-04 1.001084e-03 7.296142e-04 1.662841e-03 2.242443e-03 7.099578e-04

[778] 7.196171e-04 8.860823e-04 2.235598e-03 5.575812e-04 7.586027e-04 1.304830e-03 1.003618e-03

[785] 8.663057e-04 8.228666e-04 2.568592e-03 9.739113e-04 1.094265e-03 1.401839e-03 9.381430e-04

[792] 4.907728e-04 4.053761e-04 5.202062e-04 3.243656e-04 7.458987e-04 9.872023e-04 9.042740e-04

[799] 2.423546e-04 3.250108e-03 1.561248e-03 7.759292e-04 1.662630e-03 6.321998e-04 3.599280e-04

[806] 2.312059e-03 4.839817e-04 7.222501e-04 5.848330e-04 1.025462e-03 7.503307e-04 2.653229e-03

[813] 1.005791e-03 7.021170e-04 1.409341e-03 1.660784e-03 9.320795e-04 4.949693e-04 7.181232e-04

[820] 4.951329e-04 6.417609e-04 7.021454e-04 6.335452e-04 2.945369e-04 6.823338e-04 1.262989e-03

[827] 7.203688e-04 7.117434e-04 1.119989e-03 4.308830e-04 6.239121e-04 2.358322e-04 4.771063e-04

[834] 5.351015e-04 7.966745e-04 9.746963e-04 6.329784e-04 4.522991e-04 3.554421e-04 2.474516e-03

[841] 5.517493e-04 1.123398e-03 1.523111e-03 2.713439e-03 3.477964e-04 1.415396e-03 1.004734e-03

[848] 1.111741e-03 2.479112e-04 6.717679e-04 7.774841e-04 6.318030e-04 1.006172e-03 7.361685e-04

[855] 4.962628e-04 9.122108e-04 5.747201e-04 5.559586e-04 1.055763e-03 1.002434e-03 6.510393e-04

[862] 5.017084e-04 6.367280e-04 6.169776e-05 1.079762e-03 9.606203e-04 6.716613e-04 1.580707e-04

[869] 4.850635e-04 6.264563e-04 8.423825e-04 1.896641e-03 2.057917e-03 1.210625e-03 4.278155e-04

[876] 5.407380e-04 1.466859e-03 5.447870e-04 5.055917e-04 2.288119e-03 1.538393e-04 6.965914e-04

[883] 6.714854e-04 9.108441e-04 5.133438e-04 1.991272e-03 1.301391e-03 3.077977e-04 1.003276e-03

[890] 1.210963e-03 9.225309e-04 1.254313e-03 1.045212e-03 1.919296e-04 7.594647e-04 1.660996e-03

[897] 5.002312e-03 1.256060e-04 9.600846e-04 5.022988e-05 9.798410e-04 1.189101e-03 1.504779e-04

[904] 4.732390e-04 9.515234e-04 1.873647e-03 4.441265e-04 2.333175e-03 1.411257e-03 6.216882e-04

[911] 5.042111e-04 1.047753e-03 9.751110e-04 8.069207e-04 1.281934e-03 1.486677e-03 1.919349e-03

[918] 9.069464e-04 8.826777e-04 1.407370e-03 1.841180e-03 1.348154e-03 2.195457e-04 5.305746e-04

[925] 8.385377e-04 8.526717e-04 1.056486e-03 1.164485e-03 2.151081e-03 1.396971e-03 8.151786e-04

[932] 9.786172e-04 5.474465e-04 1.321537e-03 2.823467e-03 6.722093e-04 2.488437e-03 4.106306e-04

[939] 7.487320e-04 5.597493e-04 2.519289e-04 1.236403e-03 3.313378e-03 7.612612e-04 1.744426e-03

[946] 2.488643e-03 4.115687e-04 1.087307e-03 8.656711e-04 9.065396e-04 8.883621e-04 1.460816e-03

[953] 1.660197e-03 5.484927e-04 7.302197e-04 1.205576e-03 1.066645e-03 4.216467e-04 1.075860e-04

[960] 1.089328e-03 5.451633e-04 1.658721e-03 7.835083e-04 8.380222e-04 8.613188e-04 1.973406e-03

[967] 2.008015e-03 7.215203e-04 7.356160e-04 1.852121e-03 9.603535e-04 0.000000e+00 6.553374e-04

[974] 3.519026e-04 8.000368e-04 5.987495e-04 6.415989e-04 1.009080e-03 2.805754e-04 1.522052e-03

[981] 0.000000e+00 2.749615e-04 9.940449e-04 2.211195e-03 1.288816e-03 1.116018e-04 1.143950e-03

[988] 8.002557e-04 9.749968e-04 5.454087e-03 1.451310e-04 9.129627e-04 5.922181e-04 1.385066e-03

[995] 7.211711e-04 1.881922e-04 3.362489e-04 9.324071e-04 8.662866e-04 1.397636e-03

> sum(P[,T])

[1] 1