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HOMEWORK 23 DATA COLLECTION

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Running ExpGenLotka(2, 50) 10 times

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Trial 1:

All species survived: YES
Stable equilibrium exists: {[.6562955761, .7049100632]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.6502436282, .7050051102]
Result 2 [0.1,...]: [.5646769333, .7063284833]
Result 3 [1/k,...]: [.6497203373, .7050133189]

Trial 2:

All species survived: NO
Stable equilibrium exists: {[-1.464435146, 3.556485356], [4.166666667, 0.]}
Initial conditions agree: YES
Result 1 [0.5,...]: [4.166666569, .5973179866e-44]
Result 2 [0.1,...]: [4.166666569, .8981452891e-41]
Result 3 [1/k,...]: [4.166666569, .2527599941e-43]

Trial 3:

All species survived: NO
Stable equilibrium exists: {[0., 25.], [1.851851852, 0.]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.9142023772e-1056, 24.99999933]
Result 2 [0.1,...]: [.3286835576e-991, 24.99999933]
Result 3 [1/k,...]: [.1376925856e-1097, 24.99999933]

Trial 4:

All species survived: YES
Stable equilibrium exists: {[.6677018634, .8074534161]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.6657132742, .8078606744]
Result 2 [0.1,...]: [.6300250945, .8185930370]
Result 3 [1/k,...]: [.6630879660, .8101733883]

Trial 5:

All species survived: YES
Stable equilibrium exists: {[.7142857143, 0.]}
Initial conditions agree: YES

Result 1 [0.5,...]: [.6610814008, .6540176761e-1]
Result 2 [0.1,...]: [.6793305147, .4330265846e-1]
Result 3 [1/k,...]: [.6428921238, .8705781665e-1]

Trial 6:

All species survived: NO
Stable equilibrium exists: {[0., 5.], [2.181208054, -2.852348993]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.4197492779e-33, 4.999999950]
Result 2 [0.1,...]: [.2325552993e-32, 4.999999950]
Result 3 [1/k,...]: [.5797687885e-34, 4.999999950]

Trial 7:

All species survived: YES
Stable equilibrium exists: {[.4938271605, 4.320987654]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.4938406428, 4.320890384]
Result 2 [0.1,...]: [.4938910274, 4.320519507]
Result 3 [1/k,...]: [.4938332368, 4.320944014]

Trial 8:

All species survived: YES
Stable equilibrium exists: {[.5813953488, 1.453488372]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.6054199664, 1.448685154]
Result 2 [0.1,...]: [.6058356104, 1.448601815]
Result 3 [1/k,...]: [.5882735840, 1.452115964]

Trial 9:

All species survived: YES
Stable equilibrium exists: {[0., .7246376812], [.9345794393, -.1557632399]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.1573198091e-1, .7071507253]
Result 2 [0.1,...]: [.1553439172e-1, .7073694958]
Result 3 [1/k,...]: [.5622668027e-2, .7183716644]

Trial 10:

All species survived: NO
Stable equilibrium exists: {[0., 4.166666667], [.7605177994, -.1618122977e-1]}
Initial conditions agree: YES
Result 1 [0.5,...]: [.4306311316e-22, 4.166666574]
Result 2 [0.1,...]: [.1307483506e-21, 4.166666574]
Result 3 [1/k,...]: [.9470602879e-24, 4.166666574]

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Summary for k=2:

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All species survived: 6 out of 10 trials

Stable equilibrium existed: 10 out of 10 trials

Initial conditions agreed: 10 out of 10 trials

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Running ExpGenLotka(3, 50) 10 times

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Trial 1:

All species survived: NO

Stable equilibrium exists: {[0., 0., 16.66666667], [2261306533, 1.407035176, 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.7518051560e-103, .7475500565e-46, 16.66666588]

Result 2 [0.1,...]: [.3036805269e-102, .5058630771e-46, 16.66666588]

Result 3 [1/k,...]: [.2370345133e-106, .3043197028e-47, 16.66666588]

Trial 2:

All species survived: NO

Stable equilibrium exists: {[-.2080228515, .9842275211, -.1645553900], [0., 0., 1.515151515], [1.111111111, 0., 0.]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.7126085384, .3392814995e-4, .4372521970]

Result 2 [0.1,...]: [1.017174749, .4767058469e-3, .9686592834e-1]

Result 3 [1/k,...]: [.1900628684, .1481836008e-3, 1.061485265]

Trial 3:

All species survived: YES

Stable equilibrium exists: {[0., .6578947368, 0.], [.6990679095, 0., .4826897470]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.2427030456, .3889518175, .1302835923]

Result 2 [0.1,...]: [.6669043175, .2749326682e-1, .4558138037]

Result 3 [1/k,...]: [.1824997461e-1, .6006971131, .1370173537e-1]

Trial 4:

All species survived: YES

Stable equilibrium exists: {[.4074887375e-1, 2.185724311, .4776673534]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.1857114069, 1.789443024, .3858400064]

Result 2 [0.1,...]: [.3748214225, 1.160063296, .2686759611]

Result 3 [1/k,...]: [.1524271488, 1.891670098, .4069881623]

Trial 5:

All species survived: NO

Stable equilibrium exists: {[0., 0., 1.724137931], [0., 1.724137931, 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.3292963584e-9, .5953224303e-1, 1.636018660]

Result 2 [0.1,...]: [.3365360246e-7, .1265615803e-1, 1.705331586]

Result 3 [1/k,...]: [.2306058392e-10, .7202282881e-1, 1.617634058]

Trial 6:

All species survived: NO

Stable equilibrium exists: {[0., 2.777777778, 0.], [2.941176471, 0., 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.5933663152e-28, 2.777777698, .2585342260e-7]

Result 2 [0.1,...]: [.7256470862e-27, 2.777777698, .2560010357e-7]

Result 3 [1/k,...]: [.9318958505e-29, 2.777777693, .3135793767e-7]

Trial 7:

All species survived: NO

Stable equilibrium exists: {[0., 1.036036036, .3003003003e-1], [.8090614887, 0., .2157497303]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.1693397574e-6, 1.033194848, .4356814511e-1]

Result 2 [0.1,...]: [.1256986805e-4, 1.030803732, .5370670344e-1]

Result 3 [1/k,...]: [.1257116307e-7, 1.033916394, .4023791466e-1]

Trial 8:

All species survived: NO

Stable equilibrium exists: {[0., 2.941176471, 0.], [4.658792651, -1.443569554, 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.4767765490e-81, 2.941176380, .3159026385e-28]

Result 2 [0.1,...]: [.1041489084e-74, 2.941176380, .2892725145e-26]

Result 3 [1/k,...]: [.8154631856e-80, 2.941176380, .1600355557e-27]

Trial 9:

All species survived: YES

Stable equilibrium exists: {[0., 0., 1.041666667]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.2273553043e-1, .1117158260e-1, .9637377027]

Result 2 [0.1,...]: [.5499167718e-1, .6352630458e-1, .8261940629]

Result 3 [1/k,...]: [.7742641487e-2, .1931720365e-2, 1.016389772]

Trial 10:

All species survived: NO

Stable equilibrium exists: {[0., .3329171868, .8114856429], [.6193806194, .2297702298, 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.1355100674e-10, .3333764135, .8100092237]

Result 2 [0.1,...]: [.2563253339e-3, .3515329510, .7460181898]

Result 3 [1/k,...]: [.1708930296e-13, .3329883134, .8112572570]

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Summary for k=3:

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All species survived: 3 out of 10 trials

Stable equilibrium existed: 10 out of 10 trials

Initial conditions agreed: 6 out of 10 trials

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Running ExpGenLotka(4, 50) 10 times

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Trial 1:

All species survived: NO

Stable equilibrium exists: {[0., 5.555555556, 0., 0.], [.1396236831, 0., .7517136679, .1704467038], [24.29071647, -36.80193931, 40.98581433, -17.88022984]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.1329174109, .4935518610e-2, .7414351222, .1792901281]

Result 2 [0.1,...]: [.3865961499e-82, 5.555443925, .1979261178e-47, .5112069797e-5]

Result 3 [1/k,...]: [.1387074462, .1008777216e-2, .7497126363, .1720211173]

Trial 2:

All species survived: NO

Stable equilibrium exists: {[0., 3.571428571, 0., 0.], [7.947019868, -7.781456954, 0., 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.3776441692e-24, 3.529468831, .3722779102e-29, .5217863881e-2]

Result 2 [0.1,...]: [.1684847569e-26, 3.546863114, .2253411888e-31, .3052293890e-2]

Result 3 [1/k,...]: [.1233031527e-19, 3.485511221, .2172770477e-24, .1070638051e-1]

Trial 3:

All species survived: NO

Stable equilibrium exists: {[1.041666667, 0., 0., 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [1.039122540, .1907342817e-13, .2650564609e-2, .3168271281e-2]

Result 2 [0.1,...]: [1.034566089, .5500248854e-10, .8197442611e-2, .3089130130e-2]

Result 3 [1/k,...]: [1.036709863, .1510690955e-13, .5315213828e-2, .4704906510e-2]

Trial 4:

All species survived: NO

Stable equilibrium exists: $\{[-.2562148969, 0., .5439509686, .4205632682], [0., .1624659700, .2821199614, .3320672697], [2.380952381, 0., 0., 0.]\}$

Initial conditions agree: NO

Result 1 [0.5,...]: $[1.985990112, .2252727295e-2, .7995254103e-5, .1037941382e-8]$

Result 2 [0.1,...]: $[.6518361237e-1, .2466978444, .1754987238, .3235786622]$

Result 3 [1/k,...]: $[.4455482015, .2222100565, .7727278589e-1, .1029975134]$

Trial 5:

All species survived: NO

Stable equilibrium exists: $\{[0., .4122011542, .4534212696, 0.], [2.272727273, 0., 0., 0.]\}$

Initial conditions agree: NO

Result 1 [0.5,...]: $[.6522369055, .5918668420e-7, .2631489084, .4598050617e-3]$

Result 2 [0.1,...]: $[.1061772067, .5744978406, .1573129683, .1317483247e-1]$

Result 3 [1/k,...]: $[.2878080749, .5318616895e-3, .4592729920, .1402828926e-5]$

Trial 6:

All species survived: NO

Stable equilibrium exists: $\{[.6375838926, .4362416107, 0., 0.]\}$

Initial conditions agree: YES

Result 1 [0.5,...]: $[.6375776109, .4362435634, .2399088610e-5, .4399275798e-11]$

Result 2 [0.1,...]: $[.6375696247, .4362461003, .5407901347e-5, .3040005876e-10]$

Result 3 [1/k,...]: $[.6375795531, .4362429841, .1639058239e-5, .1495422930e-10]$

Trial 7:

All species survived: NO

Stable equilibrium exists: $\{[0., 0., .9874326750, .4488330341], [.7164480323, .3128153380, 0., 0.]\}$

Initial conditions agree: NO

Result 1 [0.5,...]: $[.1268991585e-11, .1124650976e-7, .9863166025, .4552512790]$

Result 2 [0.1,...]: $[.4899743843e-1, .7432744056e-2, .9485886247, .1545031196]$

Result 3 [1/k,...]: $[.1724480843e-19, .5087416603e-11, .9671201024, .5649564180]$

Trial 8:

All species survived: NO

Stable equilibrium exists: $\{[0., 0., 0., 3.571428571], [0., 0., 2.777777778, 0.]\}$

Initial conditions agree: YES

Result 1 [0.5,...]: $[.4052139397e-2, .1061408914e-2, 2.762192082, .2568555913e-15]$

Result 2 [0.1,...]: $[.8026240335e-2, .4903235267e-3, 2.748738125, .5977830066e-15]$

Result 3 [1/k,...]: $[.2203022870e-2, .8230832033e-3, 2.769026219, .1924938976e-15]$

Trial 9:

All species survived: NO
Stable equilibrium exists: {[-1.736111111, 0., 0., 13.36805556], [0., 3.333333333, 0., 0.], [25., 0., 0., 0.]}
Initial conditions agree: NO
Result 1 [0.5,...]: [24.93475785, .2839254610e-2, .8216002488e-192, .1572696434e-311]
Result 2 [0.1,...]: [24.99231609, .3343800649e-3, .2287039373e-212, .1001340465e-343]
Result 3 [1/k,...]: [24.83300897, .7267829172e-2, .6555171238e-157, .3557843784e-255]

Trial 10:

All species survived: NO
Stable equilibrium exists: {[0., 0., .3787878788, 6.439393939], [.1103752759, .9933774834, 0., 0.]}
Initial conditions agree: NO
Result 1 [0.5,...]: [.2770655930, .9193234766, .5462691304e-5, .2772358270e-10]
Result 2 [0.1,...]: [.1051971283, .9956445470, .2062422074e-3, .3967848644e-9]
Result 3 [1/k,...]: [.1860418526, .9599438742, .7121476898e-4, .2184184523e-9]

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Summary for k=4:

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All species survived: 0 out of 10 trials
Stable equilibrium existed: 10 out of 10 trials
Initial conditions agreed: 4 out of 10 trials

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Running ExpGenLotka(5, 50) 10 times

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Trial 1:

All species survived: NO
Stable equilibrium exists: {[-5.457704289, 3.864126528, 0., 0., 2.078840163], [.4336090936e-1, .5302850689, .4206234439, 0., .4073663172e-1], [.2159293932, 0., .9431479105, .3454404424, -.5954945994]}
Initial conditions agree: NO
Result 1 [0.5,...]: [.3943836960, .9706301799, .1395309555, .9246771125e-18, .1183375240]
Result 2 [0.1,...]: [.1015246669, .6924757241, .3384192798, .3894845357e-10, .6164881699e-1]
Result 3 [1/k,...]: [.1464089134, 1.343955035, .6277933435e-2, .3933411889e-24, .1730425713]

Trial 2:

All species survived: NO

Stable equilibrium exists: {[0., 0., 0., 3.571428571, 0.], [.2591215693e-1, .4206194180, .4487019417, 0., .6709078279e-1]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.6614611307e-5, .2498570575, .5456205342, .5648016657e-6, .4345904573]

Result 2 [0.1,...]: [.2390702593e-8, .1721820645e-18, .2808442470e-31, 3.482270320, .2498794982e-2]

Result 3 [1/k,...]: [.7067768671e-9, .1449102048, .5959406852, .6337210074e-10, .6283266158]

Trial 3:

All species survived: NO

Stable equilibrium exists: {[-.6521756743e-1, 0., .5347030373, .4658397673e-1, .8567400938], [0., 0., .6897591497, -.4334552033e-1, .5879914063], [0., 8.333333333, 0., 0., 0.], [.5130597015, 0., 0., .6996268657, 0.]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.5529824336, .3533959709e-2, .3151327407e-8, .6013246356, .1362867687e-1]

Result 2 [0.1,...]: [.6532532580, .3785069394e-2, .7122522957e-6, .3710037872, .3813485306e-3]

Result 3 [1/k,...]: [.5301739238, .2768884178e-3, .9335285993e-10, .6572404515, .3209437017e-1]

Trial 4:

All species survived: NO

Stable equilibrium exists: {[0., 1.470588235, 0., 0., 0.]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.2234078038e-1, 1.454500966, .4712411552e-6, .1772509331e-5, .1190319988e-3]

Result 2 [0.1,...]: [.4865159463e-2, 1.467100022, .4474375316e-6, .4676628183e-6, .1144846640e-4]

Result 3 [1/k,...]: [.9736737817e-2, 1.463573768, .2074304280e-5, .2196077202e-5, .4028751442e-4]

Trial 5:

All species survived: NO

Stable equilibrium exists: {[0., .1238164972, .2749683941, .4241145247, .8693572213e-2]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.1331141075e-2, .6106191301e-1, .3010438639, .4780533670, .6620975338e-1]

Result 2 [0.1,...]: [.7876367125e-2, .7525123418e-1, .2879932264, .4549431214, .6815877073e-1]

Result 3 [1/k,...]: [.8419105477e-3, .9437366346e-1, .2914250451, .4416162390, .5450269353e-1]

Trial 6:

All species survived: NO

Stable equilibrium exists: {[0., 2.007299270, 1.094890511, 0., 0.], [0.6353956164, -1.1331027514, 1.544769159, 0., 0.]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.2522381086e-5, 1.902837182, 1.125622674, .4317563805e-22, .1184169388e-28]

Result 2 [0.1,...]: [.1298939918e-3, 1.690982701, 1.185864568, .1285570004e-17, .7044613655e-22]

Result 3 [1/k,...]: [.2838600629e-6, 1.945629924, 1.113123459, .2096419456e-22, .7563729852e-29]

Trial 7:

All species survived: NO

Stable equilibrium exists: {[0., 5., 0., 0., 0.]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.2400713421, .3659360276e-41, .5172912327e-37, 1.936926069, .2037411475]

Result 2 [0.1,...]: [.3360268552, .1026264834e-37, .6435640074e-26, .5784675642, 1.797717741]

Result 3 [1/k,...]: [.1821280430, .3263855789e-52, .4166877074e-47, 2.323567441, .6561134195e-1]

Trial 8:

All species survived: NO

Stable equilibrium exists: {[0., 0., -9.615384615, 23.07692308, 0.], [0., 0., 0., 0., 10.], [0., 0., 25., 0., 0.], [0., 25., 0., 0., 0.], [4.527098831, -.6641870351, 0., 0., -.1275239107]}

Initial conditions agree: NO

Result 1 [0.5,...]: [.6414606121e-30, .1985690139e-88, 24.99921246, .7478760340e-22, .1928734918e-172]

Result 2 [0.1,...]: [.2124575425e-84, 24.99999922, .6735131498e-77, .1396960240e-49, .6800726277e-53]

Result 3 [1/k,...]: [.3564928836e-34, .5832611061e-102, 24.99979942, .2293145489e-24, .1367042278e-194]

Trial 9:

All species survived: NO

Stable equilibrium exists: {[0., 0., 6.250000000, 0., 0.], [0., .7607529685, 0., .4521684719, .1417216668]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.3057836045e-17, .7669289536, .4650406835e-4, .4217168304, .1476225073]

Result 2 [0.1,...]: [.3098259378e-15, .7651854743, .2658349430e-4, .4310735436, .1431339197]

Result 3 [1/k,...]: [.3243684014e-19, .7655258616, .1639773710e-4, .4287496376, .1468034063]

Trial 10:

All species survived: NO

Stable equilibrium exists: {[0., 0., 0., 3.846153846, 0.], [.4134577409, .7090491706, 0., 0., .8639415482e-2]}

Initial conditions agree: YES

Result 1 [0.5,...]: [.1577730703e-12, .6072724125e-28, .5289530624e-10, 3.846153793, .4167453469e-57]

Result 2 [0.1,...]: [.9730764777e-15, .2810697992e-32, .6625841057e-11, 3.846153793, .9635588428e-64]

Result 3 [1/k,...]: [.6914107202e-15, .7537210597e-33, .7535084099e-11, 3.846153793, .2279084792e-65]

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Summary for k=5:

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All species survived: 0 out of 10 trials

Stable equilibrium existed: 10 out of 10 trials

Initial conditions agreed: 4 out of 10 trials

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FINAL SUMMARY

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Question 1 (k=2):

All species survived: 6/10 cases

Stable equilibrium existed: 10/10 cases

Initial conditions agreed: 10/10 cases

Question 2 (k=3):

All species survived: 3/10 cases

Stable equilibrium existed: 10/10 cases

Initial conditions agreed: 6/10 cases

Question 3 (k=4):

All species survived: 0/10 cases

Stable equilibrium existed: 10/10 cases

Initial conditions agreed: 4/10 cases

Question 4 ($k=5$):

All species survived: 0/10 cases

Stable equilibrium existed: 10/10 cases

Initial conditions agreed: 4/10 cases