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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% ARRAY OF MEASUREMENT %%%%%%%%%%%%%%%
%%%%% Assume that the object is located at (3,4) %%%%%%%%%
%%%%% Position of the object measured 500 times %%%%%%%%%
dataWithError = [];
for i=1:500
    % 3 + {0 < number > 1} %
    x = 3 + rand;

    % 4 + {0 < number > 1} %
    y = 4 + rand;

    % Distance to origin %
    dataWithError(end+1) = sqrt(x^2 + y^2);
end

%%%%% FILL z OF KALMAN FILTER WITH DATA WITH ERROR %%%%
z(:,1) = 0;
for m = 1:length(dataWithError)
    z(:,m+1) = dataWithError(m);
end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% INITIALIZE VARIABLES OF KALMAN FILTER %%%%%%%%%%%%%%%
H = 1;
F = 1;
G = 1;
u = 0;
N = length(dataWithError);
R = std(dataWithError);
I = 1;
Q = 0;
P = 1;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% RUN KALMAN FILTER ALGORITHM %%%%%%%%%%%%%%%
x(:, 1) = 0;
for k = 2:N
    x(:, k) = F*x(:, k-1) + G*u;
    P = F*P*F' + Q;
    K = P*H' / (H*P*H' + R);
    x(:,k) = x(:,k) + K*(z(k) - H*x(:,k));
    P = (I - K*H)*P;
end

%%%%% DISPLAY AND PLOT KALMAN PREDICTION VARIABLE %%%%
disp(z);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
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Columns 1 through 7

0	5.6107	5.8077	5.5102	5.8257	5.9909	5.3667
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Columns 8 through 14

6.1036	5.5680	5.5627	6.2825	5.3989	5.6504	5.4200
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Columns 15 through 21

6.0395	6.2023	6.1301	6.0451	5.6686	5.1187	6.1338
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Columns 22 through 28

5.9577	5.6423	6.0892	5.8006	5.8270	5.8445	5.6787
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Columns 29 through 35

6.0176	5.9090	5.6065	5.6970	5.6927	5.8159	5.3185
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Columns 36 through 42

5.5102	5.5319	6.1376	5.9720	5.2462	5.8058	5.8567
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Columns 43 through 49

5.7082	5.4783	6.0165	5.4303	5.7244	5.8569	5.7933
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Columns 50 through 56

5.3579	6.0752	5.9541	5.9453	5.8591	5.5361	5.4149
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Columns 57 through 63

5.8273	5.7211	5.9480	5.8001	5.7407	5.3055	5.6758
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Columns 64 through 70

5.3586	5.1784	5.5871	6.2114	5.5903	5.5230	5.5746
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Columns 71 through 77

5.9101	5.8075	5.7192	6.0006	5.5972	5.4057	6.0568
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Columns 78 through 84

5.5995	5.5539	5.6614	5.7058	5.0745	5.4753	5.7173
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Columns 85 through 91

5.5889	5.3263	5.8430	5.6260	5.8718	5.6455	5.7716
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Columns 92 through 98

5.5603	5.6501	5.6488	5.2534	5.3737	5.9355	5.8180
Columns 99 through 105						
5.3455	5.4398	5.6843	6.0171	5.4558	5.1741	6.2376
Columns 106 through 112						
5.8249	5.3011	5.5850	5.6007	5.4848	5.5756	5.3349
Columns 113 through 119						
5.4536	5.6394	5.8332	5.7396	5.2906	5.6718	5.2370
Columns 120 through 126						
5.5707	5.6538	5.5016	5.8013	5.3131	5.8372	5.2988
Columns 127 through 133						
5.8004	5.5310	6.0456	5.2957	5.6771	5.6346	5.6786
Columns 134 through 140						
5.5473	6.1801	5.5849	5.7342	5.3667	5.1328	5.7342
Columns 141 through 147						
5.8862	5.5223	5.5266	5.2733	5.7323	5.4735	5.8861
Columns 148 through 154						
5.8892	6.1865	6.0326	5.9739	5.6664	5.8253	5.3680
Columns 155 through 161						
6.0338	5.5531	6.1251	5.3906	5.4414	6.0273	5.7857
Columns 162 through 168						
5.8881	5.8012	5.9751	5.7702	5.4601	5.7479	5.5784
Columns 169 through 175						
5.5390	5.1877	5.2872	6.0916	5.4979	5.5052	6.2236
Columns 176 through 182						
5.8190	5.7059	5.6338	5.9164	5.3130	5.8420	5.6981
Columns 183 through 189						
5.8865	5.4341	5.9715	5.3057	5.8216	5.7636	5.7571

Columns 190 through 196

5.8252	5.9685	5.9954	5.2145	5.6048	5.7997	5.7243
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Columns 197 through 203

5.8577	5.2099	5.5111	5.6429	5.8300	6.1066	6.0683
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Columns 204 through 210

5.8343	5.5970	6.1183	5.2254	5.4154	5.9384	5.5005
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Columns 211 through 217

5.8613	5.7730	5.3184	6.0515	5.7416	5.5884	5.7599
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Columns 218 through 224

5.8457	5.7484	5.9195	5.2351	6.1442	5.9392	5.6993
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Columns 225 through 231

6.1537	5.3157	5.6044	6.0074	5.5611	6.0578	5.4785
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Columns 232 through 238

5.3322	5.9120	5.8096	5.3080	5.2425	5.7485	5.2290
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Columns 239 through 245

5.6944	5.6182	6.0990	5.4692	5.7834	5.4020	5.4459
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Columns 246 through 252

5.5706	5.4604	6.1868	5.1377	5.5795	5.3816	6.2081
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Columns 253 through 259

6.0777	5.6927	5.7130	5.7757	5.1378	5.4772	5.3975
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Columns 260 through 266

5.6417	5.5927	5.8048	5.7279	5.4779	5.9783	5.6269
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Columns 267 through 273

5.5831	5.9008	5.6629	5.3092	6.2378	5.8308	5.1203
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Columns 274 through 280

5.7795	5.9739	5.2661	5.2787	5.7161	5.6141	5.6784
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Columns 281 through 287

5.6627	5.7201	6.0292	5.6220	5.5189	5.5198	5.6728
Columns 288 through 294						
5.7416	5.4630	5.6018	5.6278	5.2422	5.7699	5.3161
Columns 295 through 301						
5.7974	5.6373	5.9247	5.7550	5.3605	5.3418	5.5748
Columns 302 through 308						
6.0501	5.6914	5.0813	6.1382	5.5336	5.8476	6.1819
Columns 309 through 315						
5.6293	6.1040	6.1607	5.8247	5.7595	5.7634	5.7077
Columns 316 through 322						
5.6831	5.4395	5.9351	5.5789	5.8262	5.9427	5.8263
Columns 323 through 329						
6.0075	5.7234	5.7701	6.0449	5.6918	6.1815	5.1176
Columns 330 through 336						
6.0068	5.5885	5.8704	5.3785	5.6657	5.5474	5.9350
Columns 337 through 343						
5.9006	5.3274	5.6055	5.8161	5.2518	5.8666	5.6558
Columns 344 through 350						
5.6579	6.1422	5.3126	6.0608	5.8940	5.1831	5.9386
Columns 351 through 357						
5.3836	5.8608	5.5204	5.9883	6.3685	5.5316	5.5216
Columns 358 through 364						
5.3572	6.0312	5.8510	5.4825	5.4158	5.9968	5.9734
Columns 365 through 371						
5.6689	6.0967	6.2610	5.2801	5.1529	5.7811	5.5133
Columns 372 through 378						
5.7160	5.8979	5.4885	6.2528	5.7360	5.1427	5.5338

Columns 379 through 385

5.2649	5.7309	6.2500	5.6605	5.3996	6.1485	5.8562
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Columns 386 through 392

5.6519	5.4158	5.8055	6.0614	5.5726	5.1124	5.1744
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Columns 393 through 399

5.7602	5.6312	5.5528	5.0364	6.0545	5.9106	5.8364
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Columns 400 through 406

5.1931	5.5126	5.8217	5.4408	5.0696	5.7595	5.9580
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Columns 407 through 413

5.8485	5.3241	6.1608	5.8451	5.5717	5.2983	5.4733
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Columns 414 through 420

5.9624	5.9736	6.3680	5.5395	6.0793	5.6789	5.7765
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Columns 421 through 427

5.7442	5.1413	5.4180	5.8202	5.8462	5.4568	5.4713
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Columns 428 through 434

5.8131	5.6545	5.8299	5.8644	5.8119	5.3665	6.0080
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Columns 435 through 441

5.8090	5.6669	6.2593	5.6486	5.7031	5.9399	5.9800
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Columns 442 through 448

5.2174	6.0200	5.6211	5.3263	5.9974	5.6610	6.0138
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Columns 449 through 455

5.8244	5.2352	5.7932	5.6891	5.8657	6.0449	6.2702
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Columns 456 through 462

5.5789	5.5307	5.6542	6.2341	5.8235	6.3347	5.3567
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Columns 463 through 469

5.8349	6.2872	5.8074	5.7464	6.0629	5.5969	5.5522
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Columns 470 through 476

6.0264	5.5111	5.4792	5.4736	5.7411	5.7188	5.5060
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Columns 477 through 483

5.9597	6.0469	6.2424	6.0963	5.9863	5.7505	5.9469
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Columns 484 through 490

5.3948	5.3367	5.4618	5.5296	5.8658	5.3577	5.8827
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Columns 491 through 497

5.9706	5.7993	5.8656	5.9265	5.9631	6.1657	5.4408
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Columns 498 through 501

5.5787	5.3228	5.5061	6.2513
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