```
>> % JEPH MARI M. DALIGDIG BS-ECE III
% Problem 5: % DTFT of x2(n) = n.*(0.9 ^ n) .*(u(n)-u(n-21))
>> [x21,n21] = stepseq(0,0,22)

x21 =

  1×23 logical array

   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1↙
1


n21 =

     0     1     2     3     4     5     6     7     8     9    10    11    12    13↙
14    15    16    17    18    19    20    21    22

>>  [x22,n22] = stepseq(21,0,22)

x22 =

  1×23 logical array

   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   1↙
1


n22 =

     0     1     2     3     4     5     6     7     8     9    10    11    12    13↙
14    15    16    17    18    19    20    21    22

>> [x23,n23] = sigadd(x21,n21,-x22,n22)

x23 =

     1     1     1     1     1     1     1     1     1     1     1     1     1     1↙
1     1     1     1     1     1     1     0     0


n23 =

     0     1     2     3     4     5     6     7     8     9    10    11    12    13↙
14    15    16    17    18    19    20    21    22

>> n2 = n23

n2 =

     0     1     2     3     4     5     6     7     8     9    10    11    12    13↙
14    15    16    17    18    19    20    21    22
```

```
>> x2 = n2.*(0.9 .^ n2).*x23

x2 =

  Columns 1 through 14

        0    0.9000    1.6200    2.1870    2.6244    2.9525    3.1886    3.3481
   3.4437    3.4868    3.4868    3.4519    3.3892    3.3044

  Columns 15 through 23

   3.2028    3.0884    2.9648    2.8351    2.7017    2.5666    2.4315         0
   0

>> w2 = linspace(-pi,pi,201)

w2 =

  Columns 1 through 14

   -3.1416   -3.1102   -3.0788   -3.0473   -3.0159   -2.9845   -2.9531   -2.9217
   -2.8903   -2.8588   -2.8274   -2.7960   -2.7646   -2.7332

  Columns 15 through 28

   -2.7018   -2.6704   -2.6389   -2.6075   -2.5761   -2.5447   -2.5133   -2.4819
   -2.4504   -2.4190   -2.3876   -2.3562   -2.3248   -2.2934

  Columns 29 through 42

   -2.2619   -2.2305   -2.1991   -2.1677   -2.1363   -2.1049   -2.0735   -2.0420
   -2.0106   -1.9792   -1.9478   -1.9164   -1.8850   -1.8535

  Columns 43 through 56

   -1.8221   -1.7907   -1.7593   -1.7279   -1.6965   -1.6650   -1.6336   -1.6022
   -1.5708   -1.5394   -1.5080   -1.4765   -1.4451   -1.4137

  Columns 57 through 70

   -1.3823   -1.3509   -1.3195   -1.2881   -1.2566   -1.2252   -1.1938   -1.1624
   -1.1310   -1.0996   -1.0681   -1.0367   -1.0053   -0.9739

  Columns 71 through 84

   -0.9425   -0.9111   -0.8796   -0.8482   -0.8168   -0.7854   -0.7540   -0.7226
   -0.6912   -0.6597   -0.6283   -0.5969   -0.5655   -0.5341

  Columns 85 through 98
```

```
   -0.5027   -0.4712   -0.4398   -0.4084   -0.3770   -0.3456   -0.3142   -0.2827↙
-0.2513   -0.2199   -0.1885   -0.1571   -0.1257   -0.0942

   Columns 99 through 112

   -0.0628   -0.0314        0    0.0314    0.0628    0.0942    0.1257    0.1571↙
0.1885    0.2199    0.2513    0.2827    0.3142    0.3456

   Columns 113 through 126

    0.3770    0.4084    0.4398    0.4712    0.5027    0.5341    0.5655    0.5969↙
0.6283    0.6597    0.6912    0.7226    0.7540    0.7854

   Columns 127 through 140

    0.8168    0.8482    0.8796    0.9111    0.9425    0.9739    1.0053    1.0367↙
1.0681    1.0996    1.1310    1.1624    1.1938    1.2252

   Columns 141 through 154

    1.2566    1.2881    1.3195    1.3509    1.3823    1.4137    1.4451    1.4765↙
1.5080    1.5394    1.5708    1.6022    1.6336    1.6650

   Columns 155 through 168

    1.6965    1.7279    1.7593    1.7907    1.8221    1.8535    1.8850    1.9164↙
1.9478    1.9792    2.0106    2.0420    2.0735    2.1049

   Columns 169 through 182

    2.1363    2.1677    2.1991    2.2305    2.2619    2.2934    2.3248    2.3562↙
2.3876    2.4190    2.4504    2.4819    2.5133    2.5447

   Columns 183 through 196

    2.5761    2.6075    2.6389    2.6704    2.7018    2.7332    2.7646    2.7960↙
2.8274    2.8588    2.8903    2.9217    2.9531    2.9845

   Columns 197 through 201

    3.0159    3.0473    3.0788    3.1102    3.1416
```

```
>>  X2 = DTFT(x2,n2,w2)

X2 =

  Columns 1 through 7

   0.9328 + 0.0000i   0.6957 - 0.7098i   0.0794 - 1.1352i  -0.6696 - 1.1052i  -1.2515 -↙
0.6312i  -1.4327 + 0.0977i  -1.1401 + 0.7901i
```

```
  Columns 8 through 14

  -0.4898 + 1.1682i   0.2579 + 1.0796i   0.8032 + 0.5583i   0.9257 - 0.1883i   0.5740 -↙
0.8611i  -0.1139 - 1.1895i  -0.8642 - 1.0394i


  Columns 15 through 21

  -1.3763 - 0.4678i  -1.4437 + 0.2985i  -1.0367 + 0.9532i  -0.3160 + 1.2323i   0.4301 +↙
1.0207i   0.9009 + 0.3992i   0.9031 - 0.3855i


  Columns 22 through 28

   0.4302 - 1.0192i  -0.3336 - 1.2446i  -1.0852 - 0.9664i  -1.5229 - 0.2903i  -1.4680 +↙
0.5162i  -0.9376 + 1.1301i  -0.1408 + 1.3015i


  Columns 29 through 35

   0.6030 + 0.9554i   0.9913 + 0.2242i   0.8600 - 0.6025i   0.2519 - 1.1922i  -0.5972 -↙
1.3023i  -1.3508 - 0.8797i  -1.7048 - 0.0854i


  Columns 36 through 42

  -1.5113 + 0.7669i  -0.8405 + 1.3342i   0.0430 + 1.3817i   0.7830 + 0.8801i   1.0740 +↙
0.0214i   0.7850 - 0.8541i   0.0165 - 1.3912i


  Columns 43 through 49

  -0.9350 - 1.3637i  -1.6918 - 0.7683i  -1.9462 + 0.1687i  -1.5860 + 1.0767i  -0.7455 +↙
1.5872i   0.2426 + 1.4828i   0.9758 + 0.7893i


  Columns 50 through 56

   1.1433 - 0.2277i   0.6538 - 1.1632i  -0.3203 - 1.6327i  -1.4045 - 1.4284i  -2.1679 -↙
0.6094i  -2.2954 + 0.5136i  -1.7201 + 1.4953i


  Columns 57 through 63

  -0.6590 + 1.9317i   0.4642 + 1.6259i   1.1833 + 0.6758i   1.1776 - 0.5539i   0.4075 -↙
1.5691i  -0.8570 - 1.9416i  -2.1330 - 1.4862i


  Columns 64 through 70

  -2.9116 - 0.3470i  -2.8642 + 1.0458i  -1.9849 + 2.1373i  -0.6098 + 2.4684i   0.7027 +↙
1.8674i   1.3871 + 0.5363i   1.1014 - 1.0107i


  Columns 71 through 77

  -0.1205 - 2.1394i  -1.8602 - 2.3469i  -3.4617 - 1.4754i  -4.2853 + 0.2001i  -3.9705 +↙
2.0560i  -2.6051 + 3.3504i  -0.7224 + 3.5196i


  Columns 78 through 84
```

```
   0.8812 + 2.4238i   1.4514 + 0.4399i   0.5885 - 1.6474i  -1.5576 - 2.9305i  -4.2976 -↙
2.7387i  -6.6338 - 0.9366i  -7.6411 + 1.9657i

  Columns 85 through 91

  -6.8590 + 4.9527i  -4.5421 + 6.8665i  -1.6532 + 6.8734i   0.4288 + 4.8652i   0.4087 +↙
1.6318i  -2.3819 - 1.2892i  -7.5952 - 2.0701i

  Columns 92 through 98

 -13.7924 + 0.7703i -18.7501 + 7.7578i -20.0840 +18.0971i -16.0131 +29.7020i  -6.0215↙
+39.6512i   8.8056 +44.9604i  25.9081 +43.4491i

  Columns 99 through 105

  41.8306 +34.4373i  53.1039 +19.0472i  57.1743 + 0.0000i  53.1039 -19.0472i  41.8306↙
-34.4373i  25.9081 -43.4491i   8.8056 -44.9604i

  Columns 106 through 112

  -6.0215 -39.6512i -16.0131 -29.7020i -20.0840 -18.0971i -18.7501 - 7.7578i -13.7924 -↙
0.7703i  -7.5952 + 2.0701i  -2.3819 + 1.2892i

  Columns 113 through 119

   0.4087 - 1.6318i   0.4288 - 4.8652i  -1.6532 - 6.8734i  -4.5421 - 6.8665i  -6.8590 -↙
4.9527i  -7.6411 - 1.9657i  -6.6338 + 0.9366i

  Columns 120 through 126

  -4.2976 + 2.7387i  -1.5576 + 2.9305i   0.5885 + 1.6474i   1.4514 - 0.4399i   0.8812 -↙
2.4238i  -0.7224 - 3.5196i  -2.6051 - 3.3504i

  Columns 127 through 133

  -3.9705 - 2.0560i  -4.2853 - 0.2001i  -3.4617 + 1.4754i  -1.8602 + 2.3469i  -0.1205 +↙
2.1394i   1.1014 + 1.0107i   1.3871 - 0.5363i

  Columns 134 through 140

   0.7027 - 1.8674i  -0.6098 - 2.4684i  -1.9849 - 2.1373i  -2.8642 - 1.0458i  -2.9116 +↙
0.3470i  -2.1330 + 1.4862i  -0.8570 + 1.9416i

  Columns 141 through 147

   0.4075 + 1.5691i   1.1776 + 0.5539i   1.1833 - 0.6758i   0.4642 - 1.6259i  -0.6590 -↙
1.9317i  -1.7201 - 1.4953i  -2.2954 - 0.5136i

  Columns 148 through 154
```

```
  -2.1679 + 0.6094i  -1.4045 + 1.4284i  -0.3203 + 1.6327i   0.6538 + 1.1632i   1.1433 +↙
0.2277i   0.9758 - 0.7893i   0.2426 - 1.4828i

  Columns 155 through 161

  -0.7455 - 1.5872i  -1.5860 - 1.0767i  -1.9462 - 0.1687i  -1.6918 + 0.7683i  -0.9350 +↙
1.3637i   0.0165 + 1.3912i   0.7850 + 0.8541i

  Columns 162 through 168

   1.0740 - 0.0214i   0.7830 - 0.8801i   0.0430 - 1.3817i  -0.8405 - 1.3342i  -1.5113 -↙
0.7669i  -1.7048 + 0.0854i  -1.3508 + 0.8797i

  Columns 169 through 175

  -0.5972 + 1.3023i   0.2519 + 1.1922i   0.8600 + 0.6025i   0.9913 - 0.2242i   0.6030 -↙
0.9554i  -0.1408 - 1.3015i  -0.9376 - 1.1301i

  Columns 176 through 182

  -1.4680 - 0.5162i  -1.5229 + 0.2903i  -1.0852 + 0.9664i  -0.3336 + 1.2446i   0.4302 +↙
1.0192i   0.9031 + 0.3855i   0.9009 - 0.3992i

  Columns 183 through 189

   0.4301 - 1.0207i  -0.3160 - 1.2323i  -1.0367 - 0.9532i  -1.4437 - 0.2985i  -1.3763 +↙
0.4678i  -0.8642 + 1.0394i  -0.1139 + 1.1895i

  Columns 190 through 196

   0.5740 + 0.8611i   0.9257 + 0.1883i   0.8032 - 0.5583i   0.2579 - 1.0796i  -0.4898 -↙
1.1682i  -1.1401 - 0.7901i  -1.4327 - 0.0977i

  Columns 197 through 201

  -1.2515 + 0.6312i  -0.6696 + 1.1052i   0.0794 + 1.1352i   0.6957 + 0.7098i   0.9328 -↙
0.0000i

>> magX2 = abs(X2)

magX2 =

  Columns 1 through 14

    0.9328    0.9939    1.1380    1.2922    1.4016    1.4360    1.3871    1.2668↙
1.1100    0.9781    0.9447    1.0349    1.1950    1.3517

  Columns 15 through 28

    1.4537    1.4742    1.4083    1.2722    1.1076    0.9854    0.9820    1.1062↙
1.2886    1.4531    1.5504    1.5561    1.4684    1.3091
```

  Columns 29 through 42

    1.1298   1.0163   1.0500   1.2185   1.4327   1.6120   1.7070   1.6947↙
  1.5768   1.3824   1.1780   1.0742   1.1600   1.3913

  Columns 43 through 56

    1.6535   1.8581   1.9535   1.9169   1.7536   1.5025   1.2551   1.1657↙
  1.3343   1.6638   2.0032   2.2519   2.3521   2.2791

  Columns 57 through 70

    2.0410   1.6908   1.3627   1.3014   1.6212   2.1223   2.5997   2.9322↙
  3.0491   2.9169   2.5426   1.9953   1.4872   1.4949

  Columns 71 through 84

    2.1428   2.9947   3.7630   4.2899   4.4713   4.2440   3.5930   2.5790↙
  1.5166   1.7494   3.3188   5.0960   6.6996   7.8899

  Columns 85 through 98

    8.4602   8.2328   7.0694   4.8841   1.6822   2.7084   7.8722   13.8139↙
  20.2916   27.0346   33.7436   40.1059   45.8146   50.5870

  Columns 99 through 112

   54.1823   56.4165   57.1743   56.4165   54.1823   50.5870   45.8146   40.1059↙
  33.7436   27.0346   20.2916   13.8139   7.8722   2.7084

  Columns 113 through 126

    1.6822   4.8841   7.0694   8.2328   8.4602   7.8899   6.6996   5.0960↙
  3.3188   1.7494   1.5166   2.5790   3.5930   4.2440

  Columns 127 through 140

    4.4713   4.2899   3.7630   2.9947   2.1428   1.4949   1.4872   1.9953↙
  2.5426   2.9169   3.0491   2.9322   2.5997   2.1223

  Columns 141 through 154

    1.6212   1.3014   1.3627   1.6908   2.0410   2.2791   2.3521   2.2519↙
  2.0032   1.6638   1.3343   1.1657   1.2551   1.5025

  Columns 155 through 168

    1.7536   1.9169   1.9535   1.8581   1.6535   1.3913   1.1600   1.0742↙
  1.1780   1.3824   1.5768   1.6947   1.7070   1.6120

```
   Columns 169 through 182

    1.4327    1.2185    1.0500    1.0163    1.1298    1.3091    1.4684    1.5561↙
1.5504    1.4531    1.2886    1.1062    0.9820    0.9854


   Columns 183 through 196

    1.1076    1.2722    1.4083    1.4742    1.4537    1.3517    1.1950    1.0349↙
0.9447    0.9781    1.1100    1.2668    1.3871    1.4360


   Columns 197 through 201

    1.4016    1.2922    1.1380    0.9939    0.9328

>>  phaX2 = angle(X2)

phaX2 =

  Columns 1 through 14

    0.0000   -0.7954   -1.5010   -2.1155   -2.6745    3.0735    2.5356    1.9678↙
1.3363    0.6074   -0.2006   -0.9829   -1.6663   -2.2644


   Columns 15 through 28

   -2.8139    2.9377    2.3981    1.8218    1.1720    0.4172   -0.4035   -1.1713↙
-1.8327   -2.4140   -2.9532    2.8034    2.2633    1.6786


   Columns 29 through 42

    1.0078    0.2224   -0.6112   -1.3625   -2.0008   -2.5643   -3.0915    2.6720↙
2.1329    1.5397    0.8437    0.0199   -0.8275   -1.5590


   Columns 43 through 56

   -2.1718   -2.7153    3.0551    2.5452    2.0099    1.4086    0.6801   -0.1966↙
-1.0588   -1.7645   -2.3477   -2.8676    2.9215    2.4260


   Columns 57 through 70

    1.8996    1.2927    0.5189   -0.4397   -1.3167   -1.9864   -2.5330   -3.0230↙
2.7915    2.3192    1.8130    1.2109    0.3690   -0.7425


   Columns 71 through 84

   -1.6271   -2.2410   -2.7387    3.0949    2.6638    2.2317    1.7732    1.2221↙
0.2943   -1.2277   -2.0593   -2.5742   -3.0013    2.8898


   Columns 85 through 98

    2.5162    2.1552    1.8068    1.4829    1.3254   -2.6455   -2.8755    3.0858↙
```

```
2.7493    2.4082    2.0653    1.7215    1.3774    1.0331

  Columns 99 through 112

    0.6888    0.3444         0   -0.3444   -0.6888   -1.0331   -1.3774   -1.7215↙
-2.0653   -2.4082   -2.7493   -3.0858    2.8755    2.6455

  Columns 113 through 126

  -1.3254   -1.4829   -1.8068   -2.1552   -2.5162   -2.8898    3.0013    2.5742↙
2.0593    1.2277   -0.2943   -1.2221   -1.7732   -2.2317

  Columns 127 through 140

  -2.6638   -3.0949    2.7387    2.2410    1.6271    0.7425   -0.3690   -1.2109↙
-1.8130   -2.3192   -2.7915    3.0230    2.5330    1.9864

  Columns 141 through 154

   1.3167    0.4397   -0.5189   -1.2927   -1.8996   -2.4260   -2.9215    2.8676↙
2.3477    1.7645    1.0588    0.1966   -0.6801   -1.4086

  Columns 155 through 168

  -2.0099   -2.5452   -3.0551    2.7153    2.1718    1.5590    0.8275   -0.0199↙
-0.8437   -1.5397   -2.1329   -2.6720    3.0915    2.5643

  Columns 169 through 182

   2.0008    1.3625    0.6112   -0.2224   -1.0078   -1.6786   -2.2633   -2.8034↙
2.9532    2.4140    1.8327    1.1713    0.4035   -0.4172

  Columns 183 through 196

  -1.1720   -1.8218   -2.3981   -2.9377    2.8139    2.2644    1.6663    0.9829↙
0.2006   -0.6074   -1.3363   -1.9678   -2.5356   -3.0735

  Columns 197 through 201

   2.6745    2.1155    1.5010    0.7954   -0.0000

>> Hf_1 = figure

Hf_1 =

  Figure (1) with properties:

      Number: 1
        Name: ''
       Color: [0.9400 0.9400 0.9400]
    Position: [520 378 560 420]
```

```
        Units: 'pixels'

  Show all properties

>> set(Hf_1,'NumberTitle','off','Name','Problem 5')
>> subplot(2,1,1)
>> plot(w2/pi,magX2,'LineWidth',1.5)
>> wtick = [-1:0.2:1]

wtick =

  -1.0000   -0.8000   -0.6000   -0.4000   -0.2000        0    0.2000    0.4000⤶
0.6000    0.8000    1.0000

>> magtick = [0:10:60]

magtick =

     0    10    20    30    40    50    60

>> xlabel('\omega/\pi','Fontsize',15)
>> ylabel('|X|','Fontsize',15)
>> title('Magnitude response','Fontsize',15)
>> set(gca,'XTick',wtick)
>> set(gca,'YTick',magtick)
>> subplot(2,1,2)
>> plot(w2/pi,phaX2*180/pi,'LineWidth',1.5)
>> axis([-1,1,-200,200])
>> phatick = [-180:60:180]

phatick =

  -180  -120   -60     0    60   120   180

>> xlabel('\omega/\pi','Fontsize',15)
>> ylabel('Degrees','Fontsize',15)
>> title('Phase Response','Fontsize',15)
>> set(gca,'XTick',wtick)
>> set(gca,'YTick',phatick)
>>
```