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ΜΥΕ025: ΠΟΛΥΜΕΣΑ ΧΕΙΜΕΡΙΝΟ ΕΞΑΜΗΝΟ 2022-2023

ΜΕΡΟΣ 1

1)

$$G(u) = \sum_{x=0}^{2N-1} g(x) W_{2N}^{xu} = \sum_{x=0}^{N-1} f(x) W_{2N}^{xu} + \sum_{x=N}^{2N-1} f(2N-1-x) W_{2N}^{xu} =$$

$$= \sum_{x=0}^{N-1} f(x) e^{-j\frac{\pi}{N}xu} + \sum_{x=N}^{2N-1} f(2N-1-x) \cdot e^{-j\frac{\pi}{N}xu} = \quad \text{Θέτω } x = 2N-1-k$$

$$= \sum_{x=0}^{N-1} f(x) e^{-j\frac{\pi}{N}ux} + \sum_{x=0}^{N-1} f(x) e^{-j\frac{\pi}{N}u(2N-1-x)} =$$

$$= \sum_{x=0}^{N-1} f(x) \left(e^{-j\frac{\pi}{N}ux} + e^{j\frac{\pi}{N}ux} \cdot e^{j\frac{\pi}{N}u} \right) = \quad \text{πολ/ζω με } e^{j\frac{\pi}{2N}u} \cdot e^{-j\frac{\pi}{2N}u}$$

$$= e^{j\frac{\pi}{2N}u} \cdot e^{-j\frac{\pi}{2N}u} \cdot \sum_{x=0}^{N-1} f(x) \left(e^{-j\frac{\pi}{N}ux} + e^{j\frac{\pi}{N}ux} \cdot e^{j\frac{\pi}{N}u} \right) =$$

$$= e^{j\frac{\pi}{2N}u} \cdot \sum_{x=0}^{N-1} f(x) \left(e^{-j\frac{\pi}{2N}u} \cdot e^{-j\frac{\pi}{N}ux} + e^{j\frac{\pi}{N}ux} \cdot e^{j\frac{\pi}{2N}u} \right) =$$

$$= e^{j\frac{\pi}{2N}u} \cdot \sum_{x=0}^{N-1} f(x) \cdot 2\cos\left(\frac{(2x+1)\pi u}{2N} \right)$$

Άρα $G(u) = 2e^{j\frac{\pi}{2N}u} \cdot \sum_{x=0}^{N-1} f(x) \cos\left(\frac{(2x+1)\pi u}{2N} \right)$

$F(u) = w(u) \cdot \sum_{x=0}^{N-1} f(x) \cos\left(\frac{(2x+1)\pi u}{2N} \right)$

οπότε $\frac{F(u)}{w(u)} = \frac{G(u)}{2e^{j\frac{\pi}{2N}u}} \Rightarrow F(u) = \frac{w(u) \cdot G(u) \cdot e^{-j\frac{\pi}{2N}u}}{2}$

2) Δοκιμη mydct στον [1,2,3,4,5] & συγκριση με dct -> ιδια αποτελεσματα

```
>>
>> mydct([1,2,3,4,5])
g(x) =
g =

   1   2   3   4   5   5   4   3   2   1

G(u) =
G =

 Columns 1 through 7:

   30.00000 +  0.00000i   -9.47214 -  3.07768i    0.00000 +  0.00000i   -0.52786 -  0.72654i    0.00000 +  0.00

 Columns 8 through 10:

   -0.52786 +  0.72654i    0.00000 -  0.00000i   -9.47214 +  3.07768i

F(u) =
F =

   6.70820 + 0.00000i  -3.14950 + 0.00000i   0.00000 + 0.00000i  -0.28399 - 0.00000i   0.00000 + 0.00000i

ans =

   6.70820 + 0.00000i  -3.14950 + 0.00000i   0.00000 + 0.00000i  -0.28399 - 0.00000i   0.00000 + 0.00000i

>> dct([1,2,3,4,5])
ans =

   6.70820  -3.14950   0.00000  -0.28399   0.00000

>>
```

4) Ελεγχος του 3ου υποερωτηματος (mydct2) τρεχοντας το script dctMain()

```
function dctMain = dctMain()
  pkg load image;
  pkg load signal;
  random8x8 = rand(8);

  mydct2 = real(mydct2(random8x8));
  mydct2
  dct2 = dct2(random8x8);
  dct2
endfunction
```

```
mydct2 =

   3.84759646  -0.07846722  -0.19003668  -0.02700894   0.06427542  -0.42485407  -0.07425731  -0.32252517
  -0.15323387   0.21199192  -0.27028584  -0.46161243   0.31901328   0.00086215   0.17924656  -0.02466434
  -0.30022956   0.01223006   0.23633954   0.20341451  -0.02908177  -0.04268595   0.62904803   0.29270885
  -0.33341196  -0.06799554  -0.02777298   0.20530739  -0.06286519  -0.06764500  -0.29034277  -0.01956146
   0.12582762   0.43948998  -0.22931054   0.25141864  -0.60605186   0.37229324  -0.07626916  -0.01280447
  -0.39256703  -0.13652938  -0.20828292   0.02288624  -0.64570195  -0.13556567   0.29674082  -0.21024415
  -0.02260633  -0.00347547  -0.19581478   0.07025164  -0.17067740  -0.00847182   0.62388586  -0.11800624
  -0.28748356   0.16529980   0.26998555  -0.44642675  -0.02963552   0.19620075  -0.13885897  -0.17441179

dct2 =

   3.84759646  -0.07846722  -0.19003668  -0.02700894   0.06427542  -0.42485407  -0.07425731  -0.32252517
  -0.15323387   0.21199192  -0.27028584  -0.46161243   0.31901328   0.00086215   0.17924656  -0.02466434
  -0.30022956   0.01223006   0.23633954   0.20341451  -0.02908177  -0.04268595   0.62904803   0.29270885
  -0.33341196  -0.06799554  -0.02777298   0.20530739  -0.06286519  -0.06764500  -0.29034277  -0.01956146
   0.12582762   0.43948998  -0.22931054   0.25141864  -0.60605186   0.37229324  -0.07626916  -0.01280447
  -0.39256703  -0.13652938  -0.20828292   0.02288624  -0.64570195  -0.13556567   0.29674082  -0.21024415
  -0.02260633  -0.00347547  -0.19581478   0.07025164  -0.17067740  -0.00847182   0.62388586  -0.11800624
  -0.28748356   0.16529980   0.26998555  -0.44642675  -0.02963552   0.19620075  -0.13885897  -0.17441179
```

Τα αποτελεσματα της mydct2 και της dct2 είναι τα ιδια.

ΜΕΡΟΣ 2

Q = 1*Q1

Q = 3*Q1

Q = 5*Q1

```
>> meros2
Running cameraman for Q=1*Q1
Entropy of absolute Fbar: 0.604222
Zeros after quantization: 55852
psnr =  31.744
~~~~~~~~~~
Running cameraman for Q=3*Q1
Entropy of absolute Fbar: 0.37494
Zeros after quantization: 60789
psnr =  28.048
~~~~~~~~~~
Running cameraman for Q=5*Q1
Entropy of absolute Fbar: 0.293177
Zeros after quantization: 62154
psnr =  26.445
>>
```