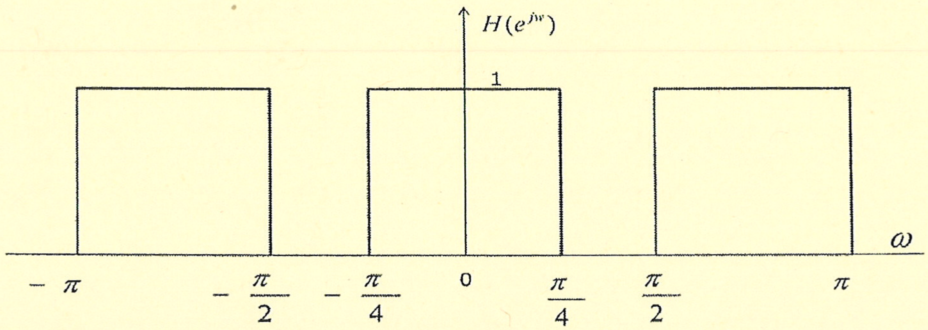
[DSP]
This problem consists of two independent parts: PART-I and PART-II.

PART-I: [6+2+6+6+5=25 points]
Consider h(n) whose DTFT $H(e^{jw})$ is shown below:



Let $g(n) = h(2n)$, we are interested in evaluating $G(e^{jw})$ in 2 ways.

a. Find $h(n) = IDTFT[H(e^{jw})]$
b. Find $g(n) = h(2n)$. Substitute n by $2n$ in $h(n)$.
c. Compute and sketch $G(e^{jw})$, the DTFT of $g(n)$.
d. Now observe that $g(n) = h(2n)$.
   Thus $G(e^{jw}) = \frac{1}{2}[H\left(e^{\frac{jw}{2}}\right) + H\left(e^{j(\frac{w}{2}-\pi)}\right)]$
   Use $H(e^{jw})$ shown above to sketch (i) $H\left(e^{\frac{jw}{2}}\right)$ (ii) $H\left(e^{j(\frac{w}{2}-\pi)}\right)$ and (iii) $G(e^{jw})$. (Note: There will be aliasing involved.) You should see that the answers of part (c) and (d) are the same.

   $H(e^{j\omega})$
e. An input signal $x(n) = \frac{\sin(\frac{n\pi}{2})}{n\pi}$ is filtered by the above filter. What is the output y(n)?

PART-II: [15 points]

Let the DFT of a 6-point complex sequence (a,b,c,d,e,f) be another complex sequence (A,B,C,D,E,F), i.e., (a,b,c,d,e,f) ↔ (A,B,C,D,E,F)

Complete the DFT/IDFT table below by finding the unspecified *x(n)* or *X(k)*. The first 9 DFT/IDFT pairs correspond to DFT size 6, and the last 6 pairs correspond to DFT size 12. You do not need to show any of your calculations. Return this page with your answers.

x(n)	*X(k)*
(A,B,C,D,E,F)	
	(6a, 6b, 6c, 6d, 6e, 6f)
(A*, B*, C*, D*, E*, F*)	
(A, F, E, D, C, B)	
(a*,b*,c*,d*,e*,f*)	
(a, f, e, d, c, b)	
	(A*,B*,C*,D*,E*,F*)
(a,-b, c,-d, e,-f)	
(a,-f, e, -d, c, -b)	
	(A, B, C, D, E, F, A, B, C, D, E, F)
(A, B, C, D, E, F, A, B, C, D, E, F)	
(A, 0, B, 0, C, 0, D, 0, E, 0, F, 0)	
	(a, b, c, d, e, f, a, b, c, d, e, f)
	(a, 0, b, 0, c, 0, d, 0, e, 0, f, 0)
(D, 0, E, 0, F, 0, A, 0, B, 0, C, 0)	