

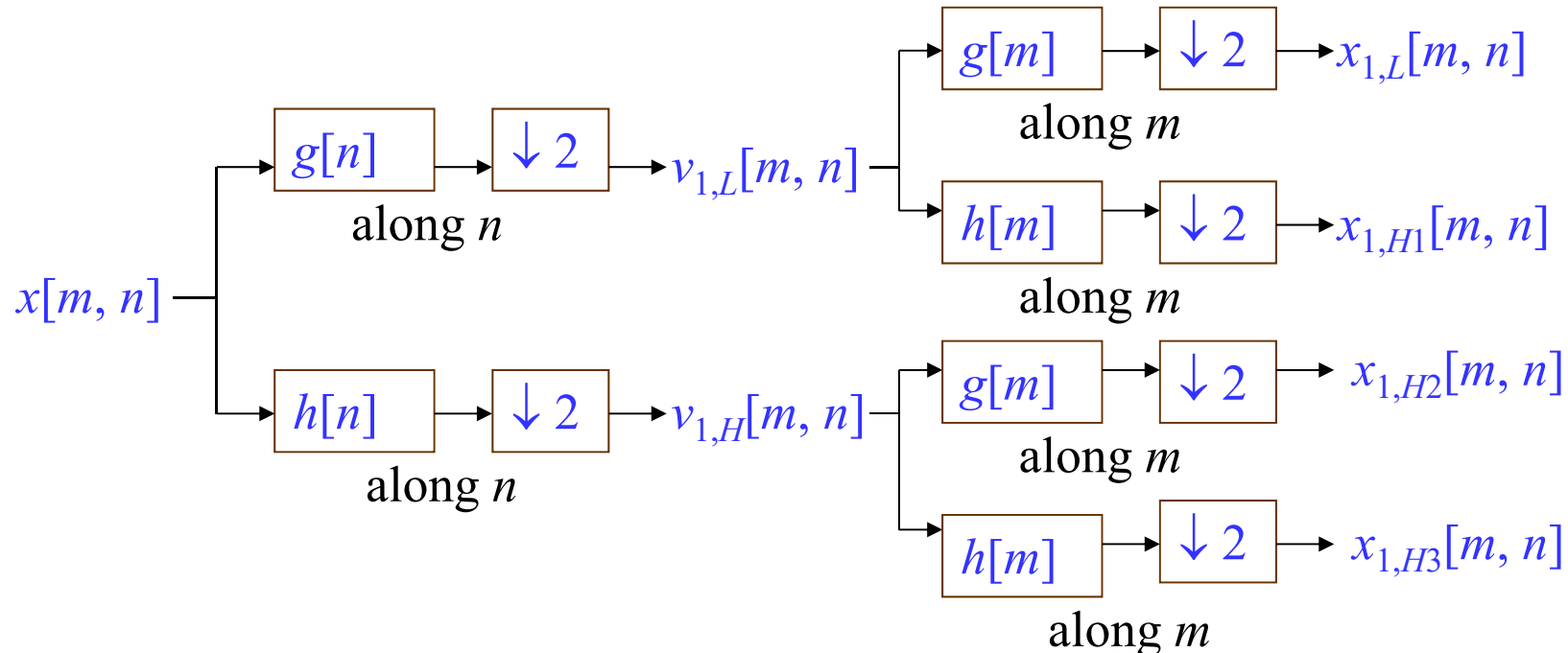
Homework 5 (Due: 25th Dec.)

- (1) What are the vanish moments of (a) $\frac{d^{12}}{dt^{12}} e^{-\pi t^2}$; (b) the sinc wavelet;
(c) the 10-point Daubechies wavelet; (d) the 18-point coiflet? (15 scores)
- (2) (a) What is the role of the admissibility criterion in the continuous wavelet transform? (b) What is the role of the generating function in the continuous wavelet transform with discrete coefficients? (10 scores)
- (3) Why the complexity of the 1-D discrete wavelet transform is $O(N)$? (10 scores)

- (4) Why the wavelet transform can be used for, (a) image compression, (b) pattern recognition, and (c) adaptive filter design? (15 scores)
- (5) (a) What is the advantage of the symlet compared to the Daubechies wavelet? (b) What is the advantage of the curvelet compared to the original 2D wavelet? (10 scores)
- (6) Suppose that the wavelet filter $g[n]$ is an orthonormal filter. (a) What is the value of a if $g[0] = 1/2$, $g[1] = a$, and $g[n] = 0$ otherwise? (b) What are the constraints of a , b , and c if $g[0] = 1/2$, $g[1] = a$, $g[2] = b$, $g[3] = c$, and $g[n] = 0$ otherwise? (10 scores)

(7) (a) Write a Matlab or Python code for the following 2-D discrete 10-point Daubechies wavelet.

$$[x_{1L}, x_{1H1}, x_{1H2}, x_{1H3}] = \text{wavedbc10}(x)$$



(b) Also write the program for the inverse 2-D discrete 10-point Daubechies wavelet transform.

$$x = \text{iwavedbc10}(x_{1L}, x_{1H1}, x_{1H2}, x_{1H3})$$

The code should be handed out by NTUCool.

(30 scores)

(Extra): Answer the questions according to your student ID number.

(ended with 1, 2, 3, 4, 6, 7, 8, 9)