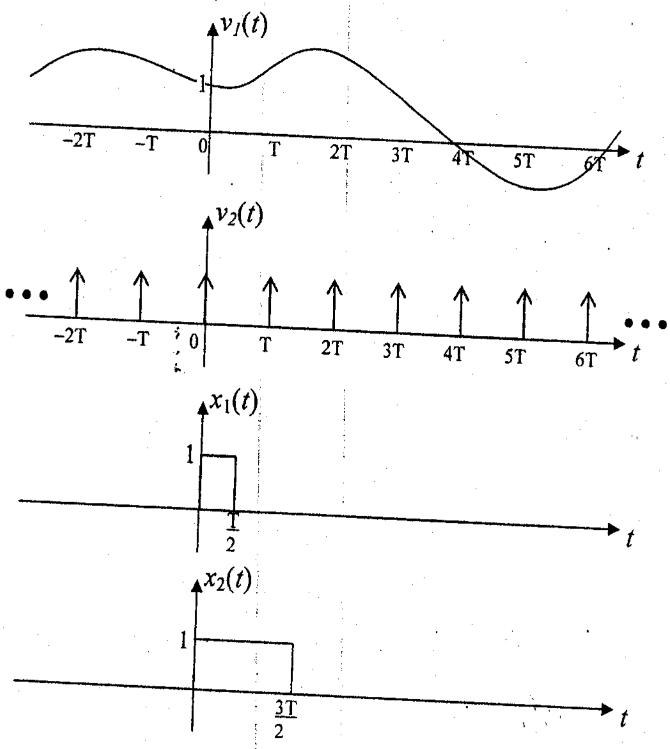
所別：電機工程學系碩士班 丙組 科目：信號與系統

1. There were three function generators, designated FunGen1, FunGen2, and FunGen3.
   (A) (5 %) At time 0, FunGen1 started to generate a 1-Hz sinusoidal wave. How many cycles of sinusoids would have been generated by FunGen1 at the time one hour after time 0?
   (B) (7 %) FunGen2 also started to generate a 1-Hz sinusoidal wave at time 0, however, with a phase delay that kept increasing at a rate of 90 degree per second (i.e., 90°/s). How many cycles of sinusoids would have been generated by FunGen2 at the time one hour after time 0?
   (C) (8 %) FunGen3 also started to generate a 1-Hz sinusoidal wave at time 0. However, the frequency kept increasing at a rate of 0.001 Hz per second. How many cycles of sinusoids would have been generated by FunGen3 at the time one hour after time 0?

2. The waveforms of $v_1(t)$, $v_2(t)$, $x_1(t)$, and $x_2(t)$ are shown below. Let $y_1(t) = v_1(t)\, v_2(t)$, $y_2(t) = y_1(t) \oplus x_1(t)$, and $y_3(t) = y_1(t) \oplus x_2(t)$, where "$\oplus$" represents convolution. Note: $v_2(t) = \sum_{n=-\infty}^{+\infty} \delta(t - nT)$.
   (A) (5 %) Sketch the waveforms of $y_1(t)$.
   (B) (7 %) Sketch the waveforms of $y_2(t)$.
   (C) (8 %) Sketch the waveforms of $y_3(t)$.



注意：背面有試題

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3. Let $H(z)=\dfrac{(1+z^{-1})^2}{100-180z^{-1}-82z^{-2}}$ be the z transform of $h(n)$.

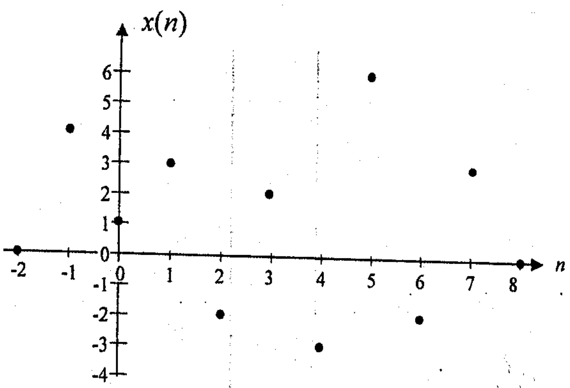
   (A) (10 %) Show the value of $h(n)$ for $n = 0$ to 3.

   (B) (10 %) Is $H(z)$ a low-pass or a high-pass filter? Why?

4. A linear time invariant system is characterized by $y(n)=\dfrac{x(n-1)+2x(n)+x(n+1)}{4}$, where y(n) and x(n) are its output and input, respectively.

   (A) (10 %) In the discrete time domain, show the values of $y(n)$ corresponding to $x(n)$ shown below.

   (B) (10 %) Sketch the frequency response of this system, which includes a magnitude response and a phase response.



5. (A) (10%) Let $X(z)=\dfrac{z^4}{(z-1)^2}$ and $Y(z)=\dfrac{z^{-3}}{(z+5)}$. Find the inverse z transform of X(z) and Y(z).

   (B) (10 %) Solve the following difference equation:

$$x(n+2)-5x(n+1)+6x(n)=7u(n),\ \text{where}\ x(0)=x(1)=0, \text{and}\ u(n)=\begin{cases}0 & n<0\\ 1 & n\geq 0\end{cases}.$$