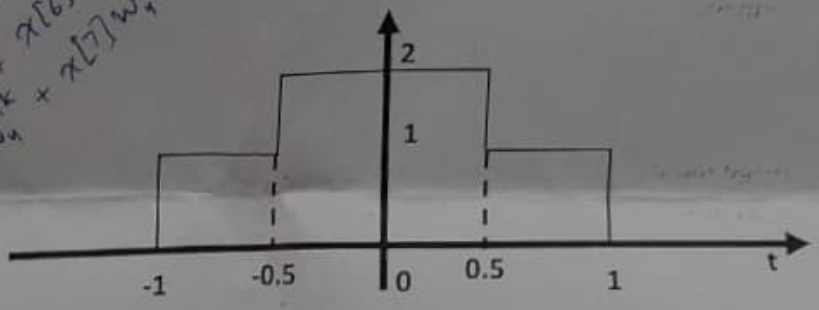
Signal Processing

Quiz-2, 2022

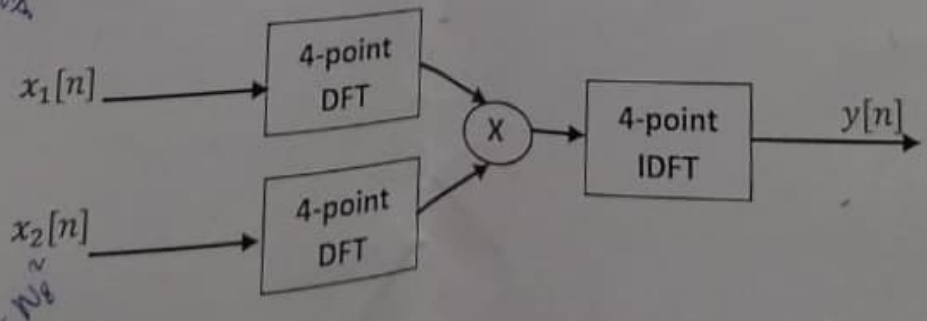
Answer all the questions, each question carry equal marks, however, sub-parts in each question may have unequal marks

1. An 8-point FFT chip found to be faulty after the manufacturing, where the input locations 1,3,5 and 7 are permanently grounded i.e the input value is zero always. Consider $y[n] = \{x[0], x[2], x[4], x[6]\}$ and its 4-point DFT is $Y[k]$.
   a. Without knowing that the chip is faulty, $x[n]$ of length 8 is given to the chip as input. Find the relation between chip output and $Y[k]$.
   b. Can an 8-point DFT obtained for an arbitrary $x[n]$ of length 8 using the two faulty chips? Justify your decision?

2. Let's consider $x(t)$ as shown below then



   a. Compute CTFT of the $x(t)$ and express the CTFT in terms of sinc function $\left(\frac{\sin k\Omega}{\Omega}\right)$ form.
   b. Let $x_1[n]$ and $x_2[n]$ are the discrete time signals obtained by sampling $x(t)$ at the time instants of $\{-0.6,0,0.6\}$ and $\{-0.8,-0.3,0.2,0.7\}$ respectively then both $x_1[n]$ and $x_2[n]$ undergone process as shown in Figure below and result $y[n]$. Find $y[n]$?



   c. **[Bonus Question: 3 marks]** Let $x(t)$ is sampled separately with $6000Hz$ and $16000Hz$ and result $x_1[n]$ and $x_2[n]$ then which sampling rate could cause frequency domain aliasing. Justify your answer?