(1.10) $x(t) = \sin(18\pi t)$, $T_s = 0.1\,s$

1) $f_s = 1/T_s = 10\,Hz \Rightarrow \boxed{f_s = 10\,Hz}$

2) $x(t) = (2\pi 9 t) \Rightarrow \boxed{f_0 = 9\,Hz}$

3) $x[n] = x(nT_s) = \sin(18\pi n T_s) = \sin\left(\frac{9\pi}{5} n\right)$

4) $f_N = f_s/2 = 5\,Hz$, $f_0 > f_N \; (9 > 5) \rightarrow$ aliasing

$f_{alias} = |f_0 - f_s| = |9 - 10| = 1\,Hz$

$\sin\left(\frac{9\pi}{5} n\right) = \sin\left(2\pi n - \frac{\pi}{5} n\right) = -\sin\left(\frac{\pi}{5} n\right)$

(1.11) $x(t) = \cos(2\pi \cdot 2t) + \cos(2\pi \cdot 9t)$, $f_s = 10Hz$

1) $x[n] = \cos(2\pi \frac{2}{10} n) + \cos(2\pi \frac{9}{10} n) = \cos(\frac{2\pi}{5} n) + \cos(\frac{9\pi}{5} n)$

2) $f_N = f_s/2 = 5Hz$, $2 < 5$ (OK AL.) , $9 > 5$ ALIASING

3) $f_{alias} = |9 - 10| = 1Hz$

$\cos(\frac{9\pi}{5} n) = \cos(2\pi n \cdot \frac{\pi}{5} n) = \cos(\frac{\pi}{5} n)$

$x[n] = \cos(\frac{2\pi}{5} n) + \cos(\frac{\pi}{5} n)$

(17) $x(t) = \cos(14\pi t)$, $f_s = 8\,Hz$

a) f_0 $\quad 14\pi t = 2\pi f_0 t \Rightarrow f_0 = 7\,Hz$

b) $T_s = \frac{1}{8} \Rightarrow x[n] = x(nT_s) = \cos\left(14\pi n \frac{1}{8}\right) = \cos\left(\frac{7\pi}{4} n\right)$

c) $f_N = f_s/2 = 8/2 = 4\,Hz \quad 7 > 4 \rightarrow$ aliasing

d) $f_{alias} = |f_0 - f_s| = |7 - 8| = 1\,Hz$

$$\cos\left(\frac{7\pi}{4} n\right) = \cos\left(2\pi n - \frac{\pi}{4} n\right) = \cos\left(\frac{\pi}{4} n\right)$$

(18) $x(t) = \cos(2\pi f_0 t)$, $f_s = 20Hz$

$x[n] = \cos(\frac{3\pi}{5} n)$

1) $\Omega_0 = 2\pi \frac{f_0}{f_s} \left(\Omega_0 = \frac{3\pi}{5}\right) \Rightarrow \frac{3\pi}{5} = 2\pi \frac{f_0}{20} \rightarrow f_0 = \frac{20 \cdot 3}{10} = 6Hz$

2) $f_0' = f_s - f_0 = 20 - 6 = 14Hz$

$x(t) = \cos(2\pi \frac{14}{20} n) = \cos(2\pi - 2\pi \frac{6}{20} n) = \cos(\frac{2\pi 6}{20} n)$

$f_0 = 6Hz$

$f_0' = 14Hz$.

(19) 1) $2f_B = 10Hz$ $f_B = 5Hz$

2) $f_N = f_S/2 = 4Hz$ $f_B > f_N$

$f_N = 10/2 = 5Hz$ $f_B = f_N$

$f_N = 14/2 = 7Hz$ $f_B < f_N$