3.3-2 A bandpass signal has bandwidth of 5 kHz centered at $f_c = 20$ kHz. Determine the permissible ranges of sampling frequency so that the original signal can be recovered from its samples. Redo the problem if the frequencies outside the band from 18 to 22 kHz have been corrupted by excessive noise to the point that the information contained in those frequencies is nonrecoverable. Determine the minimum sampling frequency so that the uncorrupted portion of the band can be recovered. If we filter out the corrupted spectrum prior to sampling, determine the minimum sampling rate.

From pg. 178 in textbook, there is no overlap within the original band $-f_2 : f_2$ at sampling frequency F_s and K repetitions if:

$$\frac{2}{K+1}\left(\frac{f_2}{B}\right) < \frac{F_s}{B} < \frac{2}{K}\left(\frac{f_2}{B} - 1\right)$$

Substituting in f_2 *and* B

$$\frac{9}{K+1} < \frac{F_s}{5} < \frac{7}{K}$$

With K = 0

$$9 < \frac{F_s}{5} < \infty$$

$$45 < F_s < \infty \qquad (we\ already\ knew\ this\ from\ nyquist)$$

With K = 1

$$22.5 < F_s < 35$$

With K = 2

$$15 < F_s < 17.5$$

With K = 3

$$11.25 < F_s < 11.667$$

So, there is no overlap when:

$$11.25 < F_s < 11.667 \ \ or \ \ 15 < F_s < 17.5 \ \ or \ \ 22.5 < F_s < 35 \ \ or \ \ 45 < F_s < \infty$$

If this signal only has an original bandwidth of 5kHz centered on 20kHz then if we stay within these bounds for sampling frequency, there should ideally be no issue with noise or corruption. I don't understand the second two parts of this problem. The frequency outside of 18 and 22Hz shouldn't be corrupted if we stay within our limits…