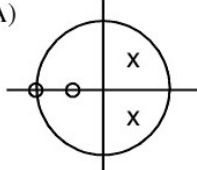
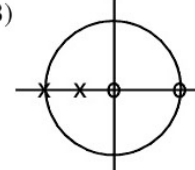
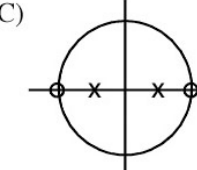
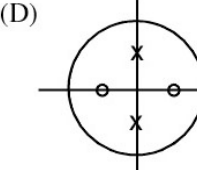


Open book/note. Each problem is worth 10 points.

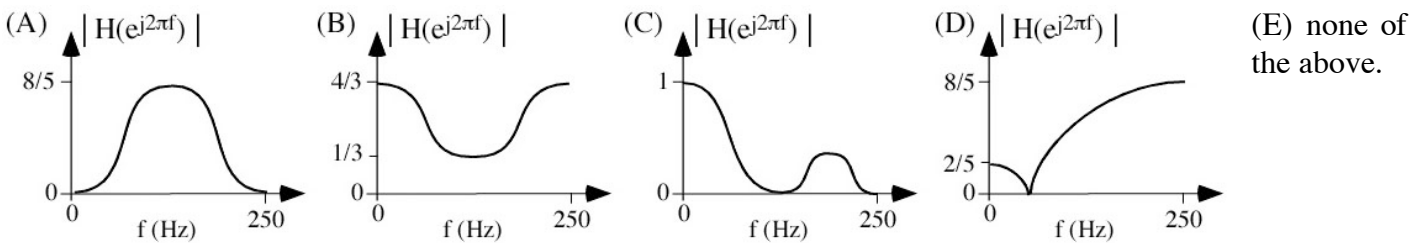
1. () We implement a digital filter according to: $y[n] = x[n] - x[n-2] + y[n-2]/4$, where $y[n]$ is the present output and $x[n]$ the present input. Which of the following is the correct transfer function $H(z)$ for this filter? (A) $(z - 1)^2 / (z - 1/4)^2$, (B) $(z^2 - 1) / (z^2 - 1/4)$, (C) $(z + 1)^2 / (z + 1/4)^2$, (D) $(z^2 + 1) / (z^2 + 1/4)$, (E) none of the above.

2. () For the above problem, which of the following is the correct pole-zero plot for this filter?

(A)  (B)  (C)  (D)  (E) none of the above.

(The big circle is the unit circle on the z-plane. A zero is shown by o and a pole by x.)

3. () For the above problem, we choose a sampling rate of 500 Hz. Which of the following is the correct frequency response, i.e. magnitude of $H(e^{j2\pi f})$, for this filter?



4. For the above problem, check off the correct properties of the filter:

<input type="checkbox"/> causal	<input type="checkbox"/> FIR	<input type="checkbox"/> 1 st -order	<input type="checkbox"/> low-pass
<input type="checkbox"/> noncausal	<input type="checkbox"/> IIR	<input type="checkbox"/> 2 nd -order	<input type="checkbox"/> high-pass
			<input type="checkbox"/> band-pass

5. () For pre-market notification (510k) we need to show that the new medical device is substantially equivalent to a device that pre-existed on the market prior to the year of (A) 1938, (B) 1945, (C) 1968, (D) 1976, (E) none of the above.

6. () Which of the following statements is incorrect? (A) Type I error, the incorrect rejection of the null hypothesis, is the false positive rate. (B) Type II error, the incorrect acceptance of the null hypothesis, is the false negative rate. (C) The sensitivity is the true negative rate. (D) The specificity is 1 minus the false positive rate. (E) none of the above.

7. () The prostate-specific antigen (PSA) test has been used as a screening test for the prostate cancer. A PSA level higher than 4.0 ng/mL is considered a positive preliminary diagnosis of prostate cancer. We conducted a study on the diagnostic accuracy of the PSA test. The study group was consisted of 12,000 patients with biopsy done on the prostate, of which 4,000 patients had prostate cancer and 8,000 patients did not. The PSA resulted in 100 false negative cases and 800 false positive cases. What is the sensitivity of the PSA test? (A) 75%, (B) 80%, (C) 85%, (D) 90%, (E) none of the above.

8. () For the above problem, what is the specificity of the PSA test? (A) 75%, (B) 80%, (C) 85%, (D) 90%, (E) none of the above.

Refer to the paper entitled "Microprocessor-based real-time QRS detection" for questions 9.

9. () What is the consequence of the sign consistency in the multiplication of backward differences (MOBD) algorithm? (A) to ensure that the QRS complex is not upside down, (B) to enhance large-magnitude signals, (C) to enhance high-frequency signals, (D) to ensure that the microprocessor can handle 2's-complement numbers, (E) none of the above.

Refer to the paper entitled "Automated performance analysis of real-time QRS detection" for question 10.

10. () What is the *valid detection window* in the error logger? (A) A time window around the R-wave reference within which a QRS detection is considered a true positive, (B) A window on the LCD display that shows the number of valid detections, (C) A probability window within which the true detection rate is considered acceptable, (D) A window of thresholds applied to the MOBD signals for detecting the QRS complexes, (E) none of the above.