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Quiz I  
Time: 20 Minutes

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**Problem 1** As an engineer, you are required to design the test performed by a fault-detector for a “black-box” that produces a sequence of i.i.d. binary random variables  $\dots, X_1, X_2, X_3, \dots$ . Previous experience shows that this “black box” has an a priori failure probability of  $\frac{1}{1025}$ . When the “black box” works properly,  $p_{X_i}(1) = p$ . When it fails, the output symbols are equally likely to be 0 or 1.

Your detector has to decide based on the observation of the past 16 symbols, i.e., at time  $k$  the decision will be based on  $X_{k-16}, \dots, X_{k-1}$ .

(a) Describe your test.

(b) What does your test decide if it observes the output sequence 0101010101010101? Assume that  $p = 1/4$ .