Practice Midterm

Practice conditions: You can use a double-sided cheat sheet and a digital calculator. You have 50 minutes.

Problem 1: *(10 points)* An urn contains 10 balls: 7 red and 3 yellow. Pick 4 balls, without replacement. What is the probability to have picked exactly 3 yellow?

Problem 2: *(20 points)* Roll 5 fair dice. What is the probability to get a square (4 identical digit, 5th one different)?

Problem 3: *(20 points)* Pick k numbers among $\{1, \ldots, n\}$ with replacement. What is the probability that they two of them are the same?

This is the birthday problem: what is the probability that 2 *students among the* 120 *enrolled in Math 394 have the same birthday? It corresponds to the probability of picking* 120 *numbers among* $\{1, \ldots, 365\}$ *(with replacement) with two of them equal.*

Problem 4: *(20 points)* Assume given two dice. One of them is fair. The other is biased: each odd digit arises with probability 1/4 and each even digit arises with probability 1/12.

Pick one of the two dice, roll it 3 times. Let X be the product of the three results. Knowing that X is odd, what is the probability that you picked the biased die?

Problem 5: Suppose that 1% of employees at a company use illegal drugs. The company performs drugs tests. If the tested person is a drug user, the test return POSITIVE 99% of the time. However, if the person is not a drug user, then the returns POSITIVE (this is called a false positive) 2% of the time.

(a) *(5 points)* What is the probability that Jordan tests POSITIVE?

(b) *(5 points)* Jordan tests POSITIVE. What is the probability that Jordan is a drug user?

(c) *(10 points)* Jordan plans to test again. What is the probability that Jordan tests POSITIVE again?

(d) *(10 points)* Jordan tests again, and is POSITIVE again. What is the probability that Jordan is a drug user?