

ECE 341 - Test #1

Combinations, Permutations, and Discrete Probability - Summer 2023

Open-Book, Open Notes. Calculators & Tarot cards allowed. Chegg or other people *not* allowed.

1) Permutations & Combinations in Bison Poker

Assume a 50-card deck of playing cards

- 10 card values (ace .. ten)
- Five suits (clubs, diamonds, hearts, spades, bison)

Each player is dealt six cards. The best 5-card hand makes up your band in Bison poker.

Calculate the odds of being dealt a full-house:

- best five cards include a 3-of-a-kind and a pair
- hand = {xxxxyz or xxxyyy},
- {x, y, z} all have different values, suit doesn't matter.

2) Conditional Probability

Assume you play the following game:

- Start by rolling a four-sided die. Then,
- Whatever number you rolled (1-4), roll that many six-sided dice:
- Your score is the sum of all dice rolled

(For example, if you roll a 3 on a 4-sided die, you then roll three six-sided dice)

Determine the probability that the sum of all dice rolled is seven.

3. Binomial Distribution

Let X be the number of 1's and 2's you get when rolling fifteen 6-sided dice.

- die roll = {1, 2} 1 point
- die roll = {3, 4, 5, 6} 0 points

Determine the probability that $X = m+1$ where m is your birth month (1..12)

m+1 birth month plus one (2..13)	probability $X = m+1$ with 15 die rolls

4. Convolution

Use convolution to determine the product of two polynomials:

$$y(x) = (3x + 4)(2x^2 + 6x + 9)$$

Note: Show your work to get full credit

a) x^0 term (determine using convolution)

b) x^1 term (determine using convolution)

c) x^2 term (determine using convolution)

d) x^3 term (determine using convolution)

5. Geometric & z-Transforms

Let

- X be the number of rolls of an 10-sided die until you get a one with the following moment-generating function:

$$X = \left(\frac{0.1}{z-0.9} \right)$$

- Y be the number of rolls of a 20-sided die until you get a one with the following moment-generating function:

$$Y = \left(\frac{0.05}{z-0.95} \right)$$

Determine the pdf for $W = X + Y$ using z-transforms

(the number of times you have to roll a 10-sided die until you get a 1, then roll a 20-sided die until you get a 1)