ECE 341 - Test #1

Combinations, Permitations, and Discrete Probability - Summer 2024

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

1) Permutations & Combinations in Bison Poker

Assume a 65-card deck of playing cards

- 13 card values (ace .. king)
- 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 three of a kind:

- best five cards include a 3-of-a-kind
- hand = {xxx abc},
- {x, a, b, c} all have different values, suit doesn't matter.

2) Conditional Probability

Assume you play the following game:

- Flip a coin. (heads or tails)
- If the coin is a heads, then roll two 6-sided dice
- If the coin is a tails, then roll two 8-sided dice

Your score is the sum of the die rolls.

Determine the probability that the sum of the dice is three.

3. Binomial Distribution

Let X be the number of 1's you get when rolling fourty 4-sided dice.

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

Determine the probability that X = m where m is your birth date (1..31)

m birth date (1..31)	probability X = m with fourty die rolls

4. Convolution

Use convolution by hand (i.e. not with Matlab or similar programs) to determine the product of two polynomials:

$$y(x) = (5x^2 + 3x + 7)(2x + 3)$$

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 number from 1..3 {1, 2, 3}:

$$X = \left(\frac{0.3}{z-0.7} \right)$$

- Y be the number of rolls a 10-sided die until you get a number from 1..4: {1, 2, 3, 4}:

$$Y = \left(\frac{0.4}{z-0.6} \right)$$

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