Mathematics 1550H – Probability I: Introduction to Probability
TRENT UNIVERSITY, Summer 2023 (S62)

Quiz #8
Recognition
Due just before midnight on Tuesday, 18 July.*

Instructions: Do all of the following problems. Please show all your work.

All of the questions relate, in one way or another, to the following process, which uses a standard 52-card deck:

Step 1. Shuffle the deck throughly.
Step 2. Draw a card from the deck.
Step 3. Record which card was drawn.
Step 4. Replace the card in the deck.
Step 5. Go to step 1.

Yes, the process never ends . . . :-)

1. The random variable H counts the number of ♡s that turn up in the first 12 iterations of the process. What are $P(H = 4)$, $E(H)$, and $V(H)$? *[1]*

2. The random variable Z returns a number for the card drawn on the forty-first iteration of the process: 0 if it is a ♡, 1 if it is a ♢, 3 if it is a ♣, and 4 if it is a ♠. What are $P(1 \leq Z \leq 3)$, $E(Z)$, and $V(Z)$? *[1]*

3. The random variable W counts the number of iterations of the process required to have an ace (*i.e.* A♡, A♢, A♣, or A♠) turn up for the first time. What are $P(W = 4)$, $E(W)$, and $V(W)$? *[1]*

4. The random variable D counts the number of iterations of the process required to have a ♢ turn up for the fourth time. What are $P(D = 4)$, $E(D)$, and $V(D)$? *[1]*

5. The random variable X_k, where $k \geq 1$, counts the number times a ♣ or ♠ turns up in in the $100(k-1)+1$st through the $100k$th iterations of the process. The random variable Y returns n if $X_n > 50$, but $X_k \leq 50$ for all k with $1 \leq k < n$. What are $P(Y = 3)$, $E(Y)$, and $V(Y)$? *[1]*

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* You should submit your solutions via Blackboard's Assignments module, preferably as a single pdf. If this fails, you may submit your work to the instructor on paper or by email to `sbilaniuk@ trentu.ca` .