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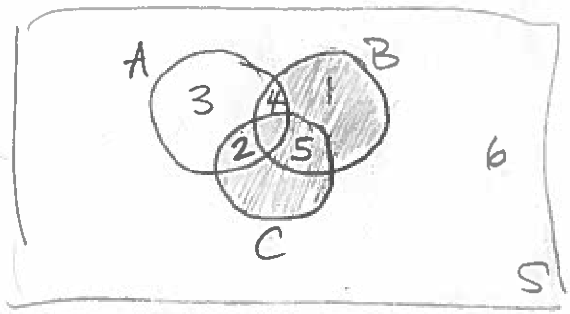
ISE 2211 • Exam I • 24 January 2020 NAME SOLUTION

1) My deranged two-year-old son Harold likes to do daredevil stunts with the explicit intention of giving his father a heart attack. The following is a list of possible outcomes in the sample space, with associated probabilities:

Outcome 1: fall off the couch	P(1) = 0.065
Outcome 2: knock over his sister	P(2) = 0.092
Outcome 3: spill his mom's beer	P(3) = 0.036
Outcome 4: pee his pants	P(4) = 0.051
Outcome 5: hit his head	P(5) = 0.120
Outcome 6: trip over his brother's toy cars	P(6) = 0.027

If event *A* is a stunt in which he knocks over his sister, pees his pants, and spills his mom's beer, event *B* is a stunt in which he falls off the couch, pees his pants, and hits his head, and event *C* is when he hits his head and knocks over his sister, draw a Venn diagram describing these events.

A {2 4 3}
B {1 4 5}
C {5 2}



+3

Is this an *exhaustive* set of events?

no; outcome 6 is not in any event +2

List all pairs of *mutually exclusive* events, if any.

None +1

Determine the outcomes associated with the following set operation, and the final probability. Additionally, shade this operation on your Venn diagram. Show all steps in order to receive maximum partial credit.

$(E_B \cap E_A') \cup E_C$

$E_A' = \{1\ 5\ 6\}$ +1

$E_B \cap E_A' = \{1\ 5\}$ +1

$(E_B \cap E_A') \cup E_C = \{1\ 2\ 5\}$ +1

$P[(E_B \cap E_A') \cup E_C] =$

$P(1) + P(2) + P(5)$

$= 0.065 + 0.092 + 0.120$

$= 0.277$ +1

shading +1

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/5

2) The following is a sample of water temperature measurements in degrees Fahrenheit from the return line of a hydronic heating system. Draw a four-bin histogram showing relative frequencies, given the following upper bin boundaries: 125, 150, 175, 200.

110.5 1
181.0 4
173.4 3
164.8 3
152.7 3
109.3 1
112.4 1
156.3 3
173.5 3
188.3 4
146.6 2
157.3 3
160.0 3
139.4 2

↓
bins
+1

frequencies:

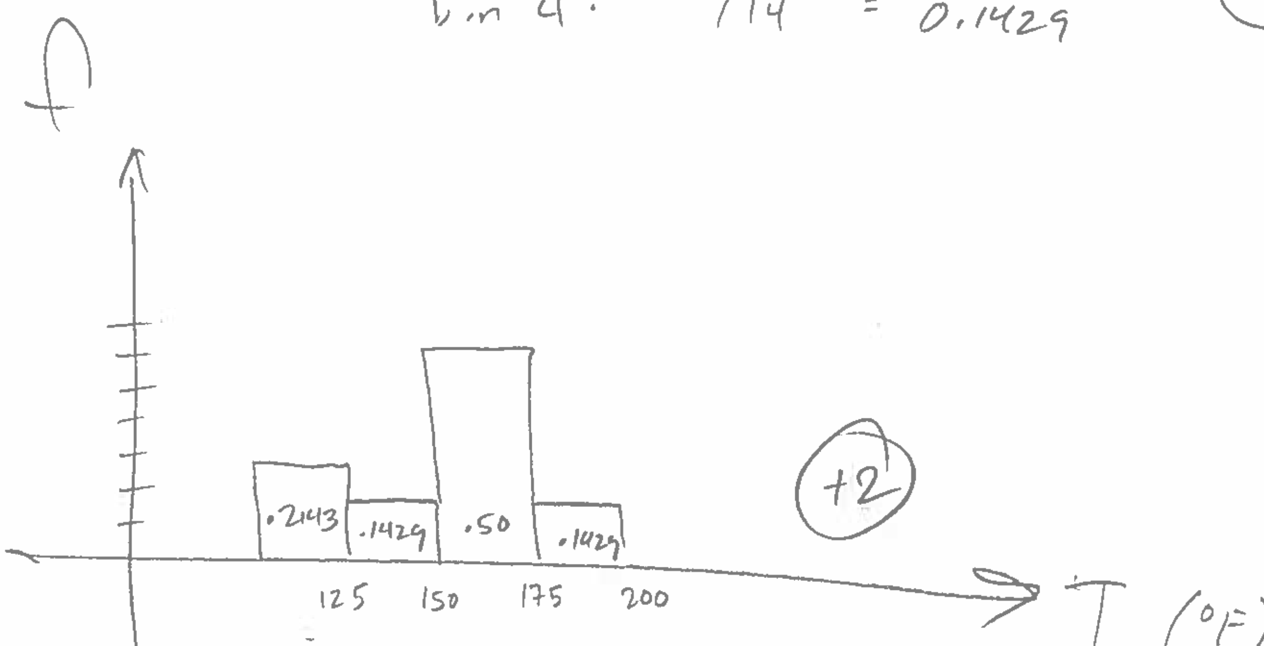
f(bin 1) = 3
f(bin 2) = 2
f(bin 3) = 7
f(bin 4) = 2

+1

relative frequencies:

bin 1: 3/14 = 0.2143
bin 2: 2/14 = 0.1429
bin 3: 7/14 = 0.50
bin 4: 2/14 = 0.1429

+1



+2

/3

3) Yellow Springs Brewery currently has twelve beers on tap; ten original recipes and two collaborations with other breweries. A *flight* is an assortment of four small glasses of beer. How many different flights are possible, given that order doesn't matter?

Formulae:

$$P\binom{n}{r} = \frac{n!}{(n-r)!}$$

$$\binom{n}{r} = \frac{n!}{r!\,(n-r)!}$$

+1

$$\binom{12}{4} = \frac{12!}{4!(12-4)!} = \frac{12 \times 11 \times 10 \times 9 \times \cancel{8!}}{4 \times 3 \times 2\,(\cancel{8!})} = 495$$

+1

How many different flights are possible, given each flight has strictly original recipes?

$$\binom{10}{4} = \frac{10!}{4!\,(10-4)!} = \frac{10 \times 9 \times 8 \times 7 \times \cancel{6!}}{4 \times 3 \times 2\,(\cancel{6!})} = 210$$

+1

Bonus (one point): A *fleet* is a flight in which all four glasses are the same beer – a Joe Tritschler exclusive. How many different fleets are possible, given strictly original recipes?

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(+1)