ISE 2211 • Exam II • 4 June 2020 NAME SOLUTION

1) My deranged son Chuck really likes root beer-flavored Dum Dums. In fact, it's the only kind he wants and he occasionally throws a fit if we don't have any. Three Dum Dums are sampled <u>without</u> replacement from a bag of 144 Dum Dums, of which twelve are root beer-flavored. First, write the sample space of all possible outcomes; use *g* to indicate a root beer-flavored Dum Dum and *b* to indicate a different flavor. (I.e., one outcome would be *gbb* if the first one was root beer and the second two were not.)

S {gbb gbg ggb ggg bbb bbg bgb bgg}.

+2

(order unimportant)

Determine probabilities associated with all outcomes. Use them to write a probability distribution for the number of root beer-flavored Dum Dums in a sample of three without replacement.

$$P(gbb) = \frac{12}{144}\cdot\frac{132}{143}\cdot\frac{131}{142} = 0.07096$$

$$P(gbg) = \frac{12}{144}\cdot\frac{132}{143}\cdot\frac{11}{142} = 0.005959$$

$$P(ggb) = \frac{12}{''}\cdot\frac{11}{''}\cdot\frac{132}{''} = 0.005959$$

$$P(ggg) = \frac{12}{''}\cdot\frac{11}{''}\cdot\frac{10}{''} = 0.0004514$$

$$P(bbb) = \frac{132}{''}\cdot\frac{131}{''}\cdot\frac{130}{''} = 0.7688$$

$$P(bbg) = \frac{132}{''}\cdot\frac{131}{''}\cdot\frac{12}{''} = 0.07096$$

$$P(bgb) = \frac{132}{}\cdot\frac{12}{}\cdot\frac{131}{} = 0.07096$$

$$P(bgg) = \frac{132}{}\cdot\frac{12}{}\cdot\frac{11}{} = 0.005959$$

+8

$P(0) = \{bbb\} = 0.7688$

$P(1) = \{gbb\ bbg\ bgb\}$
$= 0.07096 \times 3 = 0.2129$

$P(2) = \{gbg\ ggb\ bgg\}$
$= 0.005959 \times 3 = 0.01788$

$P(3) = \{ggg\} = 0.0004514$

+4

Finally, what we really need to know: determine the probability of at least one root beer-flavored Dum Dum in a sample of three without replacement, as this is the probability of avoiding a three-year-old meltdown.

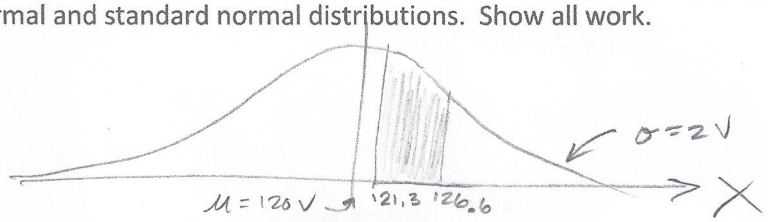
$$P(X \geq 1) = P(1) + P(2) + P(3) = 0.2312$$

+2

$$\text{OR} = 1 - P(X<1) = 1 - P(0) = 0.2312$$

2) The power company states that the mean residential line voltage is 120 V_{RMS} with a standard deviation of 2 V_{RMS}, normally-distributed. Determine the probability of a line voltage measurement ranging between 121.3 and 126.6 V_{RMS}, as an esteemed colleague measured last week. Illustrate your answer by roughly sketching this probability against both normal and standard normal distributions. Show all work.

$$Z = \frac{X - \mu}{\sigma}$$



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$$Z\Big|_{X=121.3} = \frac{121.3 - 120}{2} = 0.65$$

$$Z\Big|_{X=126.6} = \frac{126.6 - 120}{2} = 3.3$$

+1

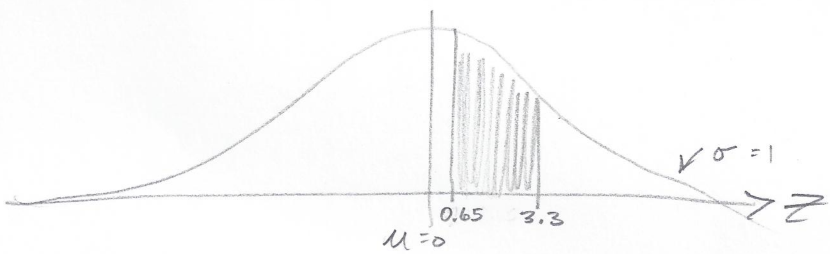

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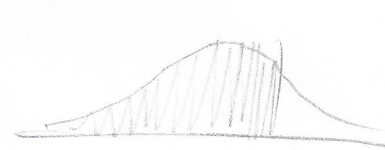
table +2

$$P(Z < 0.65) = 0.742154$$

$$P(Z < 3.3) = 0.999517$$



$$P(0.65 < Z < 3.3) = P(Z < 3.3) - P(Z < 0.65)$$

$$= 0.257363 \text{ or } 25.73\%$$

+1

+1