AP Statistics
Chapter 16 Notes (Part I of III) ← Parts II and III are AFTER this test...
(This is actually from the beginning of chapter 16, but this WILL be included on this test)

1) An insurance company offers a "death and disability" policy that pays $10,000 when the policy holder dies, or $5,000 when the policy holder is permanently disabled. Based on actuarial information, the company has calculated the probabilities shown in the table below. Let the random variable "X" represent the payout amount to a policy holder.

Calculate and interpret the mean (expected value) and standard deviation of "X".

Outcome	Death	Disability	Neither
x	$10000	$5000	0
P(x)	0.001	0.002	0.997

① Multiply each column: "x" × "P(x)"
② Add!

MEAN:

μ_x or $E(x) = \sum x \cdot P(x)$

$= \$10000(0.001) + \$5000(0.002) + \$0(0.997)$

$E(x) = \$20$

Interpretation: (this is a LONG-RUN average)
If the insurance company takes on a LARGE number of clients, their average payout per client averages out to $20.
(So if they want to stay in business, they need to charge each client MORE than $20!)

STANDARD DEVIATION (and variance)

$Var(x) = \sum (x-\mu)^2 \cdot P(x)$

$= (10000-20)^2(0.001) + (5000-20)^2(0.002) + (0-20)^2(0.997)$

$= 149600$ ← (technically, the units on variance are "DOLLARS SQUARED")

σ_x or $SD(x) = \sqrt{Var(x)}$

$= \sqrt{149600} = \$386.78$ ← For a LARGE number of clients, this is the typical/average(ish) difference from the mean payout.

2) Find the mean (expected value) and the standard deviation of the random variable "X".

x	100	200	300	400
P(x)	0.1	0.2	0.3	0.4

$E(x) = \sum x \cdot P(x)$

$E(x) = 100(0.1) + 200(0.2) + 300(0.3) + 400(0.4)$

$= \boxed{300} \leftarrow \mu_x$

$Var(x) = \sum (x - \mu)^2 \cdot P(x)$

$\sigma_x^2 = Var(x) = (100-300)^2(0.1) + (200-300)^2(0.2) + (300-300)^2(0.3) + (400-300)^2(0.4)$

$= 10000$

$SD(x) = \sqrt{10000} = \boxed{100} \leftarrow \sigma_x$

3) The table below shows the relative distribution of scores on the Comic Design AP Exam for students in Podunk last year. Calculate and interpret the mean and standard deviation for these exam scores.

x	5	4	3	2	1
P(x)	0.57	0.21	0.18	0.02	0.02

$E(x) = 5(0.57) + 4(0.21) + \ldots + 1(0.02)$

$= \boxed{4.29}$

Interpretation: In the LONG run (or for a large # of Comic Design students in Podunk), this is the mean score on the Comic Design AP exam.

$SD(x) = \sqrt{(5-4.29)^2(0.57) + \ldots (1-4.29)^2(0.02)}$

$= \sqrt{0.9259}$

$= \boxed{0.9622}$

This is the typical (or average-ish) difference from the mean exam score for a large # of Podunkian AP Comic Design students.