

--- ANSWER KEY For Practice Exam 1---

1a) Target population: All adults age 18+ living in the county.

Sampled population: Adults with a landline telephone number listed in the county directory who answer and complete the interview.

Sampling unit: A landline telephone number.

Observation unit: An individual adult who completes the interview.

Response: Whether the resident received a flu vaccine in the past year (Yes/No).

1b) Adults without landlines (e.g., cell-phone-only households), those with unlisted numbers, and non-respondents are excluded — creating coverage and non-response gaps. If these groups differ systematically in vaccination rates, the estimate may be biased.

2a) Population B (variance $45 > 15$); higher variance = more spread.

2b) Equal to (symmetric distribution $\Rightarrow$ mean = median).

2c) Skewed right; mean larger than median.

3a) $z_0 = -1.96$

3b) $P(-1.5 < Z < 2.0) = 0.9772 - 0.0668 = 0.9104$

4a) $C(8,3) = 56$ ways

4b) $1/56 \approx 0.0179$

5a) $z = (9 - 7.5)/1.1 \approx 1.364$; $P(Z > 1.364) \approx 0.0862$

5b) $z_1 \approx -1.364$, $z_2 \approx 0.455$; $P \approx 0.6752 - 0.0862 = 0.5890$

6a) $E(X) = 5(0.10) + 10(0.40) + 15(0.35) + 25(0.15) = 13.5$

6b) $E(X^2) = 215$; $\text{Var}(X) = 215 - 13.5^2 = 32.75$

6c) $P(X \geq 15) = 0.35 + 0.15 = 0.50$

7a) $P(\text{Satisfied}) = 252/400 = 0.63$

7b) $P(\text{Transit} \cup \text{Not Satisfied}) = 150/400 + 148/400 - 60/400 = 238/400 = 0.595$

7c) $P(\text{Car} \cap \text{Satisfied}) = 120/400 = 0.30$

7d) $P(\text{Satisfied} | \text{Walk/Bike}) = 42/50 = 0.84$

7e) $P(\text{Satisfied} | \text{Transit}) = 90/150 = 0.60 \neq P(\text{Satisfied}) = 0.63 \rightarrow \text{NOT independent.}$

8a) $E(X) = np = 10(0.15) = 1.5$

8b) $\sigma = \sqrt{1.275} \approx 1.129$

8c) $P(X=3) = C(10,3)(0.15)^3(0.85)^7 \approx 0.1298$

9a) $P(X=0) = e^{-4} \approx 0.0183$

9b) $E(X) = 4 \times 3 = 12$ patients

9c) $P(X \geq 2) = 1 - e^{-12} - 12e^{-12} \approx 0.9999$

10a) Tree: Disease(0.02) $\rightarrow$ Pos(0.95)/Neg(0.05); No Disease(0.98) $\rightarrow$ Pos(0.04)/Neg(0.96)

10b) $P(\text{Pos}) = 0.02(0.95) + 0.98(0.04) = 0.0582$

10c) $P(\text{Disease} | \text{Pos}) = 0.019/0.0582 \approx 0.3264$