

Homework 2

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Problem 1

p , the probability of having at least one dental checkup during a two-year period, is 0.73.

- (a) Let X be the probability of x out of 56 random individuals to have at least one dental checkup.
 $X \sim \text{Bin}(56, 0.73)$

$$P(X = 40) = f(x) = \binom{n}{x} p^x (1-p)^{n-x} = \binom{56}{40} (0.73)^{40} (1-0.73)^{56-40} = 0.11$$

Therefore, the probability that exactly 40 of these individuals will have at least one dental check up is 11.33%

- (b) The probability that at least 40 of these individuals will have at least one dental checkup can be denoted as: $P(X \geq 40) = 1 - P(X < 40) = 1 - P(X \leq 39)$

$$P(X \leq 39) = P(X = 0) + P(X = 1) + \dots + P(X = 39) = 0.33$$

Therefore, $P(X \geq 40) = 1 - P(X \leq 39) = 0.67$

$\rightarrow 66.79\%$

- (c)

$$np = 56 \times 0.73 = 40.88 > 10 \text{ and } nq = 56 \times 0.27 = 15.12 > 10$$

Thus we can approximate X to the normal distribution $X \sim N(40.88, 3.32)$ where $P(X = 40)$ becomes $P(X = 40 - \frac{1}{2})$ and $P(X \geq 40)$ becomes $P(X \geq 40 - \frac{1}{2})$

When $X \sim N(40.88, 3.32)$,

$$P(X = 39.5) = 0.11$$

$$P(X \geq 39.5) = 0.66$$

These are similar to the results of (a) and (b).