50 multiple-choice questions

Question 1 (Level 1) — *What is a sample proportion?*
In a class of 30 students, 12 wear glasses. What is the sample proportion $\hat{p}$?

(A) 0.4

(B) 12

(C) 0.12

(D) $\frac{30}{12} = 2.5$

Question 2 (Level 1) — *Population vs sample*
A country has 25 million people. A pollster surveys 1000 people. Which is the sample?

(A) The 1000 people surveyed

(B) The 25 million people

(C) Both

(D) Neither

Question 3 (Level 1) — *Variability between samples*
If you take two different random samples of 50 students, will you always get the same $\hat{p}$?

(A) No, $\hat{p}$ varies between samples

(B) Yes, $\hat{p}$ is always the same

(C) Only if the population is large

(D) Yes, if the samples are random

Question 4 (Level 1) — *Converting proportion to percentage*
If $\hat{p} = 0.35$, what percentage of the sample has the characteristic?

(A) 35%

(B) 3.5%

(C) 0.35%

(D) 65%

Question 5 (Level 1) — *Counting from proportion*
In a sample of $n = 200$, $\hat{p} = 0.15$. How many in the sample have the characteristic?

(A) 30

(B) 15

(C) 170

(D) 0.15

Question 6 (Level 1) — *Random sampling*
Why is it important to use a random sample when estimating a population proportion?

(A) To avoid bias and ensure a fair estimate

(B) To make the sample larger

(C) To guarantee $\hat{p} = p$

(D) Random sampling is not important

Question 7 (Level 1) — *Estimate quality*
Which sample size gives a more reliable estimate of the population proportion?

(A) $n = 500$

(B) $n = 50$

(C) $n = 5$

(D) All are equally reliable

Question 8 (Level 1) — *Unbiased estimator*
On average, what value does $\hat{p}$ equal?

(A) The true population proportion p

(B) 0.5

(C) 1

(D) It depends on the sample

Question 9 (Level 1) — *Sample proportion range*
What values can $\hat{p}$ take?

(A) From 0 to 1

(B) From -1 to 1

(C) From 0 to ∞

(D) Any real number

Question 10 (Level 1) — *Proportion complement*
If $\hat{p} = 0.6$, what proportion does NOT have the characteristic?

(A) 0.4

(B) 0.6

(C) 0.36

(D) -0.6

Question 11 (Level 2) — *Mean of p-hat*
If $p = 0.3$ and $n = 100$, what is $E(\hat{p})$?

(A) 0.3

(B) 30

(C) 0.03

(D) 0.7

Question 12 (Level 2) — *Standard error formula*
Write the formula for the standard error of $\hat{p}$.

(A) $\sqrt{\frac{p(1-p)}{n}}$

(B) $\frac{p(1-p)}{n}$

(C) $\sqrt{\frac{p}{n}}$

(D) $\sqrt{np(1-p)}$

Question 13 (Level 2) — *Calculating SE*
$p = 0.4$, $n = 100$. Find the standard error of $\hat{p}$.

(A) 0.049

(B) 0.24

(C) 0.0024

(D) 4.9

Question 14 (Level 2) — *Effect of n on SE*
If n is quadrupled (from 100 to 400) with $p = 0.5$, what happens to SE?

(A) SE is halved

(B) SE is quartered

(C) SE stays the same

(D) SE doubles

Question 15 (Level 2) — *Sampling distribution shape*
For large n, the sampling distribution of $\hat{p}$ is approximately what shape?

(A) Normal (bell-shaped)

(B) Uniform

(C) Binomial

(D) Skewed right

Question 16 (Level 2) — *p-hat as X/n*
If $X \sim \text{Bi}(n, p)$, what is the distribution of $\hat{p} = \frac{X}{n}$?

(A) Approximately $N\left(p, \frac{p(1-p)}{n}\right)$ for large n

(B) $\text{Bi}(n, p)$

(C) $N(0, 1)$

(D) Uniform on $[0, 1]$

Question 17 (Level 2) — *Multiple samples*
$p = 0.5$, $n = 64$. If you take many samples, about 95% of $\hat{p}$ values will lie within what range?

(A) $(0.375, 0.625)$

(B) $(0.4375, 0.5625)$

(C) $(0.25, 0.75)$

(D) $(0.3125, 0.6875)$

Question 18 (Level 2) — *SE vs SD*
What is the difference between the standard deviation of X and the standard error of $\hat{p}$ when $X \sim \text{Bi}(n, p)$?

(A) $\text{SE}(\hat{p}) = \frac{\text{SD}(X)}{n}$; SE measures proportion variability

(B) They are the same thing

(C) $\text{SE} = \text{SD}^2$

(D) $\text{SE} = n \times \text{SD}$

Question 19 (Level 2) — *Simulating sampling*
A coin has $p = 0.5$. You flip it 100 times and get 55 heads. Is $\hat{p} = 0.55$ unusual?

(A) No, $z = 1$ is within normal variation

(B) Yes, $0.55 \neq 0.5$

(C) Yes, $z = 1$ is significant

(D) Cannot determine

Question 20 (Level 2) — *Which p maximises SE?*
For fixed n, at what value of p is $\text{SE}(\hat{p})$ maximised?

(A) $p = 0.5$

(B) $p = 0$

(C) $p = 1$

(D) $p = 0.25$

Question 21 (Level 3) — *CLT for proportions*
$p = 0.6$, $n = 225$. Find $\Pr(\hat{p} > 0.64)$. Given $\Pr(Z < 1.23) \approx 0.891$.

(A) 0.109

(B) 0.891

(C) 0.040

(D) 0.500

Question 22 (Level 3) — *Range for p-hat*
$p = 0.5$, $n = 400$. Find the interval that contains the middle 95% of $\hat{p}$ values.

(A) $(0.451, 0.549)$

(B) $(0.475, 0.525)$

(C) $(0.400, 0.600)$

(D) $(0.450, 0.550)$

Question 23 (Level 3) — *Checking CLT conditions*
$p = 0.05$, $n = 100$. Can we use the normal approximation for $\hat{p}$?

(A) No, $np = 5 < 10$

(B) Yes, $n = 100$ is large enough

(C) Yes, $n(1-p) = 95 > 10$

(D) No, $p < 0.5$

Question 24 (Level 3) — *Probability of p-hat in range*
$p = 0.7$, $n = 200$. Find $\Pr(0.66 < \hat{p} < 0.74)$. Given $\Pr(Z < 1.23) = 0.891$.

(A) 0.782

(B) 0.891

(C) 0.218

(D) 0.680

Question 25 (Level 3) — *Required n for SE*
How large must n be so that $\text{SE}(\hat{p}) \leq 0.02$ when $p = 0.5$?

(A) 625

(B) 250

(C) 2500

(D) 100

Question 26 (Level 3) — *Unusual sample proportion*
$p = 0.25$, $n = 400$. Is $\hat{p} = 0.30$ significantly different from p? Given $\Pr(Z < 2.31) = 0.990$.

(A) Yes, $z \approx 2.31$ gives p-value ≈ 0.02

(B) No, 0.30 is close to 0.25

(C) Yes, but only at 1% level

(D) No, n is too large

Question 27 (Level 3) — *Comparing two sample sizes*
Sample A: $n = 100$, SE $= 0.05$. Sample B: $n = 900$, same p. Find SE for B.

(A) 0.0167

(B) 0.005

(C) 0.15

(D) 0.025

Question 28 (Level 3) — *Sampling distribution simulation*
$p = 0.4$, $n = 50$. Describe the approximate sampling distribution of $\hat{p}$.

(A) Approximately $N(0.4, 0.0693^2)$

(B) Approximately $N(0.5, 0.07^2)$

(C) $\text{Binomial}(50, 0.4)$

(D) Approximately $N(0.4, 0.24^2)$

Question 29 (Level 3) — *Proportion below threshold*
$p = 0.8$, $n = 150$. Find $\Pr(\hat{p} < 0.75)$. Given $\Pr(Z < -1.53) \approx 0.063$.

(A) 0.063

(B) 0.937

(C) 0.126

(D) 0.050

Question 30 (Level 3) — *Bias in sampling*
A survey only polls people at a shopping mall. The population proportion of shoppers who prefer Brand A is $p = 0.3$. Will this method give an unbiased estimate?

(A) No, convenience sampling is likely biased

(B) Yes, as long as n is large enough

(C) Yes, any sample gives unbiased estimates

(D) Only biased if $n < 30$

Question 31 (Level 4) — *Full CLT problem*
$p = 0.55$, $n = 500$. Find $\Pr(\hat{p} > 0.58)$. Given $\Pr(Z < 1.35) = 0.911$.

(A) 0.089

(B) 0.911

(C) 0.045

(D) 0.178

Question 32 (Level 4) — *Inverse problem for n*
$p = 0.3$. Find n so that $\Pr(|\hat{p} - p| < 0.05) \geq 0.95$.

(A) 323

(B) 322

(C) 385

(D) 200

Question 33 (Level 4) — *Testing a claim*
A company claims 90% satisfaction. In $n = 200$, $\hat{p} = 0.86$. Test at 5% significance. Given $\Pr(Z < -1.89) = 0.029$.

(A) Reject; $z = -1.89$, p-value $= 0.029 < 0.05$

(B) Do not reject; 0.86 is close to 0.90

(C) Reject; $\hat{p} < p$

(D) Do not reject; p-value $= 0.058 > 0.05$

Question 34 (Level 4) — *Combining p-hat and CI*
$n = 300$, $\hat{p} = 0.65$. Find the estimated standard error and the 95% CI.

(A) $(0.596, 0.704)$

(B) $(0.622, 0.678)$

(C) $(0.550, 0.750)$

(D) $(0.605, 0.695)$

Question 35 (Level 4) — *Sampling distribution of difference*
$\hat{p}_1$ from population with $p_1 = 0.6$ $(n_1 = 100)$ and $\hat{p}_2$ from $p_2 = 0.5$ $(n_2 = 100)$. Find $E(\hat{p}_1 - \hat{p}_2)$ and $\mathrm{SE}(\hat{p}_1 - \hat{p}_2)$.

(A) $E = 0.1$, SE $= 0.07$

(B) $E = 0.1$, SE $= 0.049$

(C) $E = 0.55$, SE $= 0.07$

(D) $E = 0.1$, SE $= 0.007$

Question 36 (Level 4) — *Increasing precision*
Currently SE $= 0.04$ with $n = 150$. What n is needed to reduce SE to 0.02?

(A) 600

(B) 300

(C) 2400

(D) 450

Question 37 (Level 4) — *Two-sided probability*
$p = 0.45$, $n = 250$. Find $\Pr(|\hat{p} - 0.45| > 0.05)$. Given $\Pr(Z < 1.59) = 0.944$.

(A) 0.112

(B) 0.056

(C) 0.944

(D) 0.888

Question 38 (Level 4) — *Exam proportion question*
A manufacturer claims the defect rate is $p = 0.02$. In a sample of 500, 18 are defective. Is this consistent with the claim at 5% significance?

(A) Reject; $z = 2.56$, p-value $\approx 0.01 < 0.05$

(B) Do not reject; 18 out of 500 is small

(C) Do not reject; $\hat{p} < 0.05$

(D) Reject; $\hat{p} > 0.02$

Question 39 (Level 4) — *Variance of p-hat*
$p = 0.35$, $n = 200$. Find $\mathrm{Var}(\hat{p})$ and $\mathrm{SD}(\hat{p})$.

(A) Var ≈ 0.00114, SD ≈ 0.0337

(B) Var $= 0.2275$, SD $= 0.477$

(C) Var $= 0.0337$, SD $= 0.00114$

(D) Var $= 0.35$, SD $= 0.591$

Question 40 (Level 4) — *Interpreting SE*

$p = 0.5$, $n = 1600$. The SE of $\hat{p}$ is 0.0125. In repeated sampling, approximately 99.7% of $\hat{p}$ values will fall within what range?

(A) $(0.4625, 0.5375)$

(B) $(0.475, 0.525)$

(C) $(0.4875, 0.5125)$

(D) $(0.4250, 0.5750)$

Question 41 (Level 5) — *Exact vs approximate*

$X \sim \mathrm{Bi}(20, 0.5)$. Find the exact $\Pr(\hat{p} > 0.7) = \Pr(X > 14)$ and compare with the normal approximation.

(A) Exact ≈ 0.021; normal ≈ 0.037 (overestimates)

(B) Both give ≈ 0.021

(C) Exact ≈ 0.037; normal ≈ 0.021

(D) Both give ≈ 0.037

Question 42 (Level 5) — *Continuity correction*

$X \sim \mathrm{Bi}(100, 0.4)$. Use the continuity correction to find $\Pr(X \geq 45)$ via the normal approximation.

(A) ≈ 0.179

(B) ≈ 0.154 (without CC)

(C) ≈ 0.500

(D) ≈ 0.046

Question 43 (Level 5) — *Deriving the variance of p-hat*

If $X \sim \mathrm{Bi}(n, p)$ and $\hat{p} = \frac{X}{n}$, derive $\mathrm{Var}(\hat{p})$.

(A) $\frac{p(1-p)}{n}$

(B) $np(1-p)$

(C) $\frac{p(1-p)}{n^2}$

(D) $\frac{p}{n}$

Question 44 (Level 5) — *Power of a test*
$H_0 : p = 0.5$, $H_1 : p = 0.6$, $n = 100$. Reject H_0 if $\hat{p} > 0.58$. Find the power. Given $\Pr(Z < -0.41) \approx 0.341$.

(A) 0.659

(B) 0.341

(C) 0.050

(D) 0.950

Question 45 (Level 5) — *Finding critical value*
$H_0 : p = 0.4$, one-sided test at $\alpha = 0.05$, $n = 250$. Find the critical value $\hat{p}_c$ such that $\Pr(\hat{p} > \hat{p}_c | p = 0.4) = 0.05$.

(A) 0.451

(B) 0.461

(C) 0.440

(D) 0.431

Question 46 (Level 5) — *CLT proof sketch*
The Central Limit Theorem states that $\frac{\hat{p}-p}{\sqrt{p(1-p)/n}} \to N(0, 1)$ as $n \to \infty$. What is the name of this convergence?

(A) Convergence in distribution

(B) Almost sure convergence

(C) Convergence in probability

(D) Mean square convergence

Question 47 (Level 5) — *Two-sample z-test*
Sample 1: $n_1 = 200$, $\hat{p}_1 = 0.45$. Sample 2: $n_2 = 300$, $\hat{p}_2 = 0.38$. Test $H_0 : p_1 = p_2$ at 5%. Given $\Pr(Z < 1.63) \approx 0.948$.

(A) Do not reject; $z \approx 1.56$, p-value $\approx 0.12 > 0.05$

(B) Reject; the proportions differ

(C) Reject; $z > 1$

(D) Do not reject; $\hat{p}_1 > \hat{p}_2$

Question 48 (Level 5) — *Delta method application*

If $\hat{p} \sim N(p, \frac{p(1-p)}{n})$ approximately, find the approximate distribution of $g(\hat{p}) = \ln\left(\frac{\hat{p}}{1-\hat{p}}\right)$ (log-odds).

(A) $N\left(\ln\frac{p}{1-p},\ \frac{1}{np(1-p)}\right)$

(B) $N\left(\ln\frac{p}{1-p},\ \frac{p(1-p)}{n}\right)$

(C) $N\left(p,\ \frac{1}{np(1-p)}\right)$

(D) $N\left(0,\ \frac{1}{n}\right)$

Question 49 (Level 5) — *Stratified sampling effect*

A population has two strata: Stratum 1 ($N_1 = 600$, $p_1 = 0.3$) and Stratum 2 ($N_2 = 400$, $p_2 = 0.7$). A proportionally stratified sample of $n = 100$ is taken. Find $\text{Var}(\hat{p}_{\text{strat}})$.

(A) 0.0021

(B) 0.0042

(C) 0.0046

(D) 0.021

Question 50 (Level 5) — *Exam multi-step question*

A polling company wants $\Pr(|\hat{p} - p| < 0.03) \geq 0.99$ for any p. Find the required sample size.

(A) 1844

(B) 1843

(C) 1068

(D) 2401

Solutions

Q1: (A)
$\hat{p} = \frac{12}{30} = 0.4$.

Q2: (A)
The 1000 people surveyed are the sample. The 25 million is the population.

Q3: (A)
No. Different random samples will generally give different values of $\hat{p}$ due to sampling variability.

Q4: (A)
$0.35 \times 100 = 35\%$.

Q5: (A)
Count $= 200 \times 0.15 = 30$.

Q6: (A)
Random sampling avoids bias and ensures $\hat{p}$ is a fair estimate of the population proportion p.

Q7: (A)
A larger sample ($n = 500$) gives a more reliable estimate than a smaller one ($n = 50$).

Q8: (A)
On average, $E(\hat{p}) = p$ (the true population proportion). $\hat{p}$ is unbiased.

Q9: (A)
$\hat{p}$ can take values from 0 to 1 (inclusive), since it is $\frac{X}{n}$ where $0 \le X \le n$.

Q10: (A)
$1 - 0.6 = 0.4$.

Q11: (A)
$E(\hat{p}) = p = 0.3$.

Q12: (A)
$\mathrm{SE}(\hat{p}) = \sqrt{\frac{p(1-p)}{n}}$.

Q13: (A)
$\mathrm{SE} = \sqrt{\frac{0.24}{100}} = \sqrt{0.0024} \approx 0.049$.

Q14: (A)
SE is halved. $\mathrm{SE}_{100} = \frac{0.5}{10} = 0.05$, $\mathrm{SE}_{400} = \frac{0.5}{20} = 0.025$.

Q15: (A)
By the Central Limit Theorem, $\hat{p}$ is approximately normally distributed for large n.

Q16: (A)
$\hat{p}$ has mean p and variance $\frac{p(1-p)}{n}$. For large n, $\hat{p} \approx N\left(p, \frac{p(1-p)}{n}\right)$.

Q17: (A)
$\mathrm{SE} = 0.0625$. 95% range: $0.5 \pm 2(0.0625) = (0.375, 0.625)$.

Q18: (A)
$\mathrm{SD}(X) = \sqrt{np(1-p)}$ measures variability of counts. $\mathrm{SE}(\hat{p}) = \frac{\mathrm{SD}(X)}{n} = \sqrt{\frac{p(1-p)}{n}}$ measures variability of the proportion.

Q19: (A)
$z = 1$. $\Pr(|Z| > 1) \approx 0.32$. Not unusual — well within normal variation.

Q20: (A)
$\mathrm{SE} = \sqrt{\frac{p(1-p)}{n}}$. Since $p(1-p)$ is maximised at $p = 0.5$, SE is maximised there.

Q21: (A)
$\mathrm{SE} = \sqrt{\frac{0.24}{225}} = \frac{0.4899}{15} \approx 0.03266$. $z = \frac{0.64-0.6}{0.03266} \approx 1.23$. $\Pr(\hat{p} > 0.64) = 1 - 0.891 = 0.109$.

Q22: (A)
$\mathrm{SE} = \sqrt{\frac{0.25}{400}} = 0.025$. Interval: $0.5 \pm 1.96(0.025) = 0.5 \pm 0.049 = (0.451, 0.549)$.

Q23: (A)
$np = 100 \times 0.05 = 5 < 10$. The condition fails, so the normal approximation is not appropriate.
Q24: (A)
SE ≈ 0.0324. $z_1 = \frac{0.66-0.7}{0.0324} \approx -1.23$. $z_2 = \frac{0.74-0.7}{0.0324} \approx 1.23$. Pr $= 0.891 - 0.109 = 0.782$.
Q25: (A)
$n \geq \frac{0.25}{0.0004} = 625$.
Q26: (A)
SE $= \sqrt{\frac{0.1875}{400}} = \sqrt{0.000469} \approx 0.02165$. $z = \frac{0.30-0.25}{0.02165} \approx 2.31$. p-value $= 2(1-0.990) = 0.020 < 0.05$. Yes, significantly different.
Q27: (A)
$\text{SE}_B = 0.05 \times \frac{\sqrt{100}}{\sqrt{900}} = 0.05 \times \frac{10}{30} = 0.0167$.
Q28: (A)
$\hat{p} \sim N\left(0.4, \frac{0.24}{50}\right) = N(0.4, 0.0048)$. SD ≈ 0.0693.
Q29: (A)
SE ≈ 0.0327. $z = \frac{0.75-0.8}{0.0327} \approx -1.53$. $\Pr(\hat{p} < 0.75) \approx 0.063$.
Q30: (A)
No. This is a convenience sample, likely biased. Mall shoppers may differ from the general population.
Q31: (A)
SE $= \sqrt{\frac{0.2475}{500}} = \sqrt{0.000495} \approx 0.02225$. $z = \frac{0.58-0.55}{0.02225} \approx 1.35$. $\Pr(\hat{p} > 0.58) = 1 - 0.911 = 0.089$.
Q32: (A)
$1.96 \times \sqrt{\frac{0.21}{n}} \leq 0.05$. $\sqrt{\frac{0.21}{n}} \leq 0.02551$. $\frac{0.21}{n} \leq 0.000651$. $n \geq 322.6$. So $n = 323$.
Q33: (A)
SE $= \sqrt{\frac{0.09}{200}} = 0.02121$. $z = \frac{0.86-0.90}{0.02121} = -1.89$. One-tailed p-value $= 0.029 < 0.05$. Reject claim.
Q34: (A)
SE $= \sqrt{\frac{0.65 \times 0.35}{300}} = \sqrt{0.000758} \approx 0.02754$. CI: $0.65 \pm 1.96(0.02754) = (0.596, 0.704)$.
Q35: (A)
$E = 0.6 - 0.5 = 0.1$. SE $= \sqrt{\frac{0.24}{100} + \frac{0.25}{100}} = \sqrt{0.0049} = 0.07$.
Q36: (A)
$\frac{\text{SE}_1}{\text{SE}_2} = \frac{\sqrt{n_2}}{\sqrt{n_1}}$. $\frac{0.04}{0.02} = \sqrt{\frac{n_2}{150}}$. $4 = \frac{n_2}{150}$. $n_2 = 600$.
Q37: (A)
SE $= \sqrt{\frac{0.2475}{250}} \approx 0.03146$. $z = \frac{0.05}{0.03146} \approx 1.59$. $\Pr(|\hat{p} - 0.45| > 0.05) = 2(1-0.944) = 0.112$.
Q38: (A)
$\hat{p} = 0.036$. SE $= \sqrt{\frac{0.0196}{500}} = 0.00626$. $z = \frac{0.036-0.02}{0.00626} = 2.56$. p-value $\approx 2 \times 0.005 = 0.01 < 0.05$. Reject claim.
Q39: (A)
$\text{Var}(\hat{p}) = \frac{0.35 \times 0.65}{200} = \frac{0.2275}{200} = 0.0011375$. $\text{SD}(\hat{p}) = \sqrt{0.0011375} \approx 0.0337$.
Q40: (A)
$0.5 \pm 3(0.0125) = 0.5 \pm 0.0375 = (0.4625, 0.5375)$.
Q41: (A)
Exact: $\Pr(X \geq 15) = \frac{\binom{20}{15} + \cdots + \binom{20}{20}}{2^{20}} = \frac{15504+4845+1140+190+20+1}{1048576} = \frac{21700}{1048576} \approx 0.0207$. Normal: $z = \frac{0.7-0.5}{\sqrt{0.25/20}} = \frac{0.2}{0.1118} = 1.79$. Pr ≈ 0.037. The normal overestimates for small n.
Q42: (A)
$\mu = 40$, $\sigma = \sqrt{24} \approx 4.899$. With CC: $z = \frac{44.5-40}{4.899} \approx 0.918$. $\Pr(Z > 0.918) \approx 0.179$.

Q43: (A)
$\mathrm{Var}(\hat{p}) = \frac{1}{n^2}\mathrm{Var}(X) = \frac{np(1-p)}{n^2} = \frac{p(1-p)}{n}$.
Q44: (A)
Under H_1: SE $= \sqrt{\frac{0.24}{100}} = 0.049$. $z = \frac{0.58-0.6}{0.049} = -0.41$. Power $= \Pr(Z > -0.41) = 1 - 0.341 = 0.659$.
Q45: (A)
SE $= \sqrt{\frac{0.24}{250}} = 0.03098$. $\hat{p}_c = 0.4 + 1.645(0.03098) = 0.4 + 0.051 = 0.451$.
Q46: (A)
This is convergence in distribution (also called weak convergence).
Q47: (A)
Pooled $\hat{p} = 0.408$. SE $= \sqrt{0.408 \times 0.592\left(\frac{1}{200} + \frac{1}{300}\right)} = \sqrt{0.2415 \times 0.00833} = \sqrt{0.002013} \approx 0.04487$. $z = \frac{0.45-0.38}{0.04487} = 1.56$. Two-tailed p-value $= 2(1-0.941) \approx 0.119 > 0.05$. Do not reject.
Q48: (A)
$g'(p) = \frac{1}{p(1-p)}$. $\mathrm{Var}(g(\hat{p})) \approx \frac{1}{[p(1-p)]^2} \cdot \frac{p(1-p)}{n} = \frac{1}{np(1-p)}$.
Q49: (A)
$w_1 = 0.6$, $w_2 = 0.4$. Var $= 0.36 \times \frac{0.21}{60} + 0.16 \times \frac{0.21}{40} = 0.36 \times 0.0035 + 0.16 \times 0.00525 = 0.00126 + 0.00084 = 0.0021$.
Q50: (A)
$2.576 \times \sqrt{\frac{0.25}{n}} \leq 0.03$. $\sqrt{\frac{0.25}{n}} \leq 0.01164$. $\frac{0.25}{n} \leq 0.0001356$. $n \geq \frac{0.25}{0.0001356} = 1843.3$. So $n = 1844$.