Section A — Concepts and Skills — 150 marks

Answer **all six** questions from this section.

Question 1 (25 marks)

When Conor rings Ciara's house, the probability that Ciara answers the phone is $\frac{1}{5}$.

(a) Conor rings Ciara's house once every day for 7 consecutive days. Find the probability that she will answer the phone on the 2nd, 4th, and 6th days but not on the other days.

$P(N,Y,N,Y,N,Y,N) = \left(\frac{4}{5}\right)\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)$

$= \frac{256}{78125}$ ✓

(b) Find the probability that she will answer the phone for the 4th time on the 7th day.

$\underbrace{\binom{6}{3}\left(\frac{1}{5}\right)^3\left(\frac{4}{5}\right)^3}_{\text{3 times in 1st 6 days}}\left(\frac{1}{5}\right) = \frac{256}{15625}$

(c) Conor rings her house once every day for n days. Write, in terms of n, the probability that Ciara will answer the phone at least once.

$P(\text{at least once}) = 1 - P(\text{none})$

$= 1 - \binom{n}{0}\left(\frac{1}{5}\right)^0\left(\frac{4}{5}\right)^n$

$= 1 - \left(\frac{4}{5}\right)^n$

(d) Find the minimum value of n for which the probability that Ciara will answer the phone at least once is greater than 99%.

$P(\text{at least once}) > 0.99$

$\therefore \quad 1 - \left(\frac{4}{5}\right)^n > 0.99$

$\therefore \quad 0.01 > \left(\frac{4}{5}\right)^n$

let $\quad 0.01 = \left(\frac{4}{5}\right)^n$

$\Rightarrow \log_{\frac{4}{5}} 0.01 = n = 20.64$

$\therefore$ Least n is 21

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