# Edexcel (U.K.) Pre 2017

## Questions By Topic

## S2 Chap01 Binomial Distribution

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1. It is estimated that 4% of people have green eyes. In a random sample of size $n$, the expected number of people with green eyes is 5.

   (a) Calculate the value of $n$.

   **(3)**

   The expected number of people with green eyes in a second random sample is 3.

   (b) Find the standard deviation of the number of people with green eyes in this second sample.

   **(4)**

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**5.** In a manufacturing process, 2% of the articles produced are defective. A batch of 200 articles is selected.

(a) Giving a justification for your choice, use a suitable approximation to estimate the probability that there are exactly 5 defective articles.

**(5)**

(b) Estimate the probability there are less than 5 defective articles.

**(2)**

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**5.** A manufacturer produces large quantities of coloured mugs. It is known from previous records that 6% of the production will be green.

A random sample of 10 mugs was taken from the production line.

(a) Define a suitable distribution to model the number of green mugs in this sample.

**(1)**

(b) Find the probability that there were exactly 3 green mugs in the sample.

**(3)**

A random sample of 125 mugs was taken.

(c) Find the probability that there were between 10 and 13 (inclusive) green mugs in this sample, using

    (i) a Poisson approximation,

**(3)**

    (ii) a Normal approximation.

**(6)**

**2.** The random variable $J$ has a Poisson distribution with mean 4.

(a) Find $P(J \geqslant 10)$.

**(2)**

The random variable $K$ has a binomial distribution with parameters $n = 25$, $p = 0.27$.

(b) Find $P(K \leqslant 1)$.

**(3)**

**Q2**

**(Total 5 marks)**

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**3.** For a particular type of plant 45% have white flowers and the remainder have coloured flowers. Gardenmania sells plants in batches of 12. A batch is selected at random.

Calculate the probability that this batch contains

(a) exactly 5 plants with white flowers,

**(3)**

(b) more plants with white flowers than coloured ones.

**(2)**

Gardenmania takes a random sample of 10 batches of plants.

(c) Find the probability that exactly 3 of these batches contain more plants with white flowers than coloured ones.

**(3)**

Due to an increasing demand for these plants by large companies, Gardenmania decides to sell them in batches of 50.

(d) Use a suitable approximation to calculate the probability that a batch of 50 plants contains more than 25 plants with white flowers.

**(7)**

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**7.** (a) (i) Write down two conditions for $X \sim \text{Bin}(n, p)$ to be approximated by a normal distribution $Y \sim \text{N}(\mu, \sigma^2)$.

**(2)**

(ii) Write down the mean and variance of this normal approximation in terms of $n$ and $p$.

**(2)**

A factory manufactures 2000 DVDs every day. It is known that 3% of DVDs are faulty.

(b) Using a normal approximation, estimate the probability that at least 40 faulty DVDs are produced in one day.

**(5)**

The quality control system in the factory identifies and destroys every faulty DVD at the end of the manufacturing process. It costs £0.70 to manufacture a DVD and the factory sells non-faulty DVDs for £11.

(c) Find the expected profit made by the factory per day.

**(3)**

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**2.**    The probability of a bolt being faulty is 0.3. Find the probability that in a random sample of 20 bolts there are

(a)  exactly 2 faulty bolts,

**(2)**

(b)  more than 3 faulty bolts.

**(2)**

These bolts are sold in bags of 20. John buys 10 bags.

(c)  Find the probability that exactly 6 of these bags contain more than 3 faulty bolts.

**(3)**

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2.  In a large college 58% of students are female and 42% are male. A random sample of 100 students is chosen from the college. Using a suitable approximation find the probability that more than half the sample are female.

**(7)**

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**5.** A factory produces components of which 1% are defective. The components are packed in boxes of 10. A box is selected at random.

(a) Find the probability that the box contains exactly one defective component.

**(2)**

(b) Find the probability that there are at least 2 defective components in the box.

**(3)**

(c) Using a suitable approximation, find the probability that a batch of 250 components contains between 1 and 4 (inclusive) defective components.

**(4)**

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1. A bag contains a large number of counters of which 15% are coloured red. A random sample of 30 counters is selected and the number of red counters is recorded.

   (a) Find the probability of no more than 6 red counters in this sample.

   **(2)**

   A second random sample of 30 counters is selected and the number of red counters is recorded.

   (b) Using a Poisson approximation, estimate the probability that the total number of red counters in the combined sample of size 60 is less than 13.

   **(3)**

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**1.** A manufacturer supplies DVD players to retailers in batches of 20. It has 5% of the players returned because they are faulty.

(a) Write down a suitable model for the distribution of the number of faulty DVD players in a batch.

**(2)**

Find the probability that a batch contains

(b) no faulty DVD players,

**(2)**

(c) more than 4 faulty DVD players.

**(2)**

(d) Find the mean and variance of the number of faulty DVD players in a batch.

**(2)**

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**2.** Bhim and Joe play each other at badminton and for each game, independently of all others, the probability that Bhim loses is 0.2

Find the probability that, in 9 games, Bhim loses

(a) exactly 3 of the games,

**(3)**

(b) fewer than half of the games.

**(2)**

Bhim attends coaching sessions for 2 months. After completing the coaching, the probability that he loses each game, independently of all others, is 0.05

Bhim and Joe agree to play a further 60 games.

(c) Calculate the mean and variance for the number of these 60 games that Bhim loses.

**(2)**

(d) Using a suitable approximation calculate the probability that Bhim loses more than 4 games.

**(3)**

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**1.** A disease occurs in 3% of a population.

(a) State any assumptions that are required to model the number of people with the disease in a random sample of size $n$ as a binomial distribution.

**(2)**

(b) Using this model, find the probability of exactly 2 people having the disease in a random sample of 10 people.

**(3)**

(c) Find the mean and variance of the number of people with the disease in a random sample of 100 people.

**(2)**

A doctor tests a random sample of 100 patients for the disease. He decides to offer all patients a vaccination to protect them from the disease if more than 5 of the sample have the disease.

(d) Using a suitable approximation, find the probability that the doctor will offer all patients a vaccination.

**(3)**

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**5.** The probability of an electrical component being defective is 0.075
The component is supplied in boxes of 120

(a) Using a suitable approximation, estimate the probability that there are more than 3 defective components in a box.

**(5)**

A retailer buys 2 boxes of components.

(b) Estimate the probability that there are at least 4 defective components in each box.

**(2)**

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**8.**  In a large restaurant an average of 3 out of every 5 customers ask for water with their meal.

A random sample of 10 customers is selected.

(a)  Find the probability that

  (i)   exactly 6 ask for water with their meal,

  (ii)  less than 9 ask for water with their meal.

**(5)**

A second random sample of 50 customers is selected.

(b)  Find the smallest value of $n$ such that

$$P(X < n) \geqslant 0.9$$

where the random variable $X$ represents the number of these customers who ask for water.

**(3)**

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blank

**3.** A random variable $X$ has the distribution B(12, $p$).

(a) Given that $p = 0.25$ find

(i) P($X < 5$)

(ii) P($X \geqslant 7$)

**(3)**

(b) Given that P($X = 0$) = 0.05, find the value of $p$ to 3 decimal places.

**(3)**

(c) Given that the variance of $X$ is 1.92, find the possible values of $p$.

**(4)**