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Samples and Distributions

(Haf 2006)

1. A random sample of 3 numbers is chosen without replacement from the 5 numbers (1, 1, 2, 3, 4).
- (a) List all the possible samples. [2]
- (b) Determine the sampling distributions of
- (i) the sample mean,
- (ii) the sample median. [6]

(Haf 2007)

1. Six cards are numbered 1, 2, 2, 3, 3, 3 respectively. Two of these cards are chosen at random without replacement. Let X denote the sum of the two numbers on the chosen cards.
- (a) Show that
- $$P(X = 3) = \frac{2}{15}. \quad [2]$$
- (b) Find the sampling distribution of X . [6]

(Haf 2008)

1. A bag contains six £2 coins and four £1 coins. A random sample of three coins is selected from the bag without replacement.
- (a) Find the sampling distribution of the total value of these three coins. [7]
- (b) Verify that the expected value of this total is three times the mean value of the ten coins in the bag. [3]

(Haf 2009)

1. A bag contains 8 balls, 5 of which are blue and 3 of which are red. A random sample of 5 balls is taken from the bag. Let X denote the number of blue balls in the sample.
- (a) When sampling is done **without replacement**,
- (i) find the sampling distribution of X ,
- (ii) calculate $E(X)$. [7]
- (b) Suppose now that the sampling is done **with replacement**.
- (i) Identify the distribution of X in this case.
- (ii) Show that the value of $E(X)$ is the same as in (a). [3]

(Haf 2010)

3. A bag contains six coins, of which one is a 20p coin, three are 10p coins and two are 5p coins. A random sample of three of these coins is taken **without replacement**. Determine the sampling distribution of the total value of the coins in the sample. [9]

(Haf 2011)

3. A bag contains five balls numbered 1, 1, 2, 3, 4 respectively. A random sample of three of these balls is taken **without replacement**.

(a) Determine the sampling distribution of the sum of the numbers on the selected balls. [5]

(b) Determine the expected value of the largest number shown on the selected balls. [3]

(Haf 2012)

1. Three numbers are chosen at random **without replacement** from the set $\{1, 2, 3, 4, 5\}$. Determine the sampling distribution of

(a) the mean of the three chosen numbers, [5]

(b) the median of the three chosen numbers. [2]

(Haf 2013)

2. A bag contains 10 balls, of which 3 are red and 7 are blue. A random sample of 4 balls is taken from the bag **without replacement**. Let X denote the number of red balls in the sample and let Y denote the number of blue balls in the sample. Find the sampling distribution of $|X - Y|$. [8]

(Haf 2015)

1. A bag contains 6 balls numbered 1, 2, 2, 4, 6, 6 respectively. Three of these balls are selected at random, without replacement, and X_1, X_2, X_3 denote the numbers on these balls written in ascending order. The sample range R is defined by $R = X_3 - X_1$ and the sample median M is defined by $M = X_2$.

Determine the sampling distributions of R and M . [8]

(Haf 2016)

1. A bag contains one 50p coin, two 10p coins and three 2p coins. A random sample of three coins is selected from the bag. Calculate the expected value of the coin of highest value in the sample. [8]

(Haf 2017)

2. Each of three fair dice has its six faces numbered 1, 2, 3, 4, 5, 6 respectively. The three dice are thrown simultaneously and the score on each dice is defined as the number on the uppermost face. Let X denote the highest score on these three dice.

(a) Show that

$$P(X \leq x) = \left(\frac{x}{6}\right)^3 \quad \text{for } x = 1, 2, 3, 4, 5, 6. \quad [2]$$

(b) Deduce an expression in terms of x for $P(X = x)$, valid for $x = 1, 2, 3, 4, 5, 6$. [2]

(c) Determine the most likely value of X . [2]

(Haf 2018)

1. A bag contains six balls, three of which are numbered 1, two of which are numbered 2 and one of which is numbered 3. Three of these balls are selected at random, without replacement. Given that X denotes the largest number on the three selected balls, determine the value of $E(X)$. [7]