STATISTICS QUESTION BANK PRACTICING ADVANCED LEVEL QUESTIONS

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With Answers

PRACTICE ALWAYS MAKES PERFECT.

With A……….s

DISCRETE RANDOM VARIABLES
ZIMSEC PAST EXAM QUESTIONS

1. Two players A and B take turns to toss a tetrahedral die until a 4 appear. A person who first throws a 4 wins the game. Assuming that A throws first, Find
   i. The average number of tosses required before a game is lost. [2]
   ii. The probability that A wins the game. [5]

NOV 2003

2. In a large city, one person in 65 dies of AIDS. If a random sample of 250 people is taken,
   i. Find the probability that the sample includes at most two people who die of AIDS. [4]
   ii. Calculate the number of people who must be taken in order that the probability of including at least one person who die of AIDS is 0,95. [4]

NOV 2003

3. Transcription checkers have found out from experience that 1 in 20 mark sheets have recording errors. A checker randomly draws a sample of 8 mark sheets from a marker. Calculate the probability that
   (i) 3 of the mark sheets will have recording errors. [3]
   (ii) at most 2 of the 8 mark sheets will have recording errors. [2]

NOV 2004

4. It is given that X – Geo (0.2). Find
   i. $P(X \geq 3)$, [1]
   ii. Var(X). [2]

NOV 2004

5. A multiple choice test has 60 questions. Each question has three possible answers with only one correct. Using a suitable approximation, find the probability that,
   i. One passes given that a score of at least 25 is a pass mark. [3]
   ii. Guesswork yields 10 to 15 correct answers for 42 questions. [5]

NOV 2004

6. (a) State the conditions under which the Poisson distribution may be used as an approximation to the Binomial distribution [1]

   (b) Belts are manufactured in a factory. It has been found over a long period of time that on average, 1 defective belt is produced in every 100. The belts are packed in cartons of 50. Assuming that the process is working normally, determine to 3 decimal places, the probability that in 5 cartons there will be no defective belt.
   JUN 2004 [3]

7. According to a criminal lawyer, 60% of all Zimbabweans chosen for jury duty oppose capital punishment. To check this, random sample of 25 prospective jurors

is selected and x, the number opposing capital punishment is recorded. If the lawyer's assertion is correct,

(a) Calculate the probability that X is

(i) Less than 9, [4]

(ii) more than 13. [3]

(b) What would you think about the lawyer's assertion if the observed value of X is less than 9? Explain [2]

JUN 2004

8. A Harare company keeps records on the number of workers who arrive late for work. In a period of 300 days, there were 500 late arrivals. Assume that the number of late arrivals per day follows a Poisson distribution. Find

(a) The expected number of late arrivals per day. [1]

(b) the probability of exactly 2 late arrivals on any given day, [2]

(c) the probability of exactly 10 late arrivals in 5 days. [3]

NOV 2007

9. A library contains a very large number of books of which 60% are fiction and the remainder are non-fiction.

(a) Determine correct to three decimal places, the probability that a random collection of 6 books from the library contains 5 or more fiction books. [3]

(b) Using a suitable approximation determine the probability that a random collection of 200 books from the library contains exactly 80 non-fiction books. [5]

NOV 2008

10. Let X be the number of claims for severe medical condition requiring hospitalisation received by a medical insurance company in a year. Such medical conditions are estimated to affect 1 in 1000 of the population in a year.

(a) Given that the medical company receives *n* claims in a year, State the distribution of X. [1]

(b) This medical insurance company deals with two manufacturing companies A and B with 500 and 750 employees respectively. Find the probability that the number of claims received from

i. Company A is 2 or more. [5]

ii. both companies is 2. [3]

NOV 2008

11. An airline experiences delays at an average rate of 1 per two weeks.

(a) Calculate the probability that at least 2 delays will be experienced in a particular three-week period. [5]

(b) The air line's financial year last for 51 weeks. Taking their year to consist of three week periods, find the probability that in a year there are at most two three-week periods during which at least 2 delays occur. [4]

Given that the probability of at least one delay occurring in a period of n weeks is greater than 0,875, find the least possible value of n. ***JUN 2008*** [4]

12. The owners of a motel in Mutare have noticed that in a long run 40% of the people who stop and inquire about a room for the night, actually book a room. How many inquiries must the owners answer to be 99% sure of at least one booking? [5]

NOV 2009

13. Data from the Consumer Council of Zimbabwe shows that 42% of Zimbabweans eat breakfast every day. Find the probability that in a random sample of 300 Zimbabweans, the number who eat breakfast every day is

i) at most 100 [6]
ii) from 130 to 140 [4]

NOV 2009

14. Three players A, B and C, in that order, throw a fair cubical die. The first to throw a 6 wins. The game is continued until one of the players wins.

(a) Find the probability that A wins

(i) on his first throw, [1]
ii) on his second throw, [2]
iii) the game. [3]

(b) Given that the probability that B wins is $\frac{30}{91}$, find the probability that C wins. [2]

NOV 2010

15. In a chemical industry workmen had a 20 % chance of suffering from an occupational disease. Find the number of workmen who could have been selected at random before the probability that at least one of them contracted the disease, become greater than 0,9. [5]

NOV2011

16. a) State the condition under which a normal distribution be used to approximate a binomial distribution. [1]

b) It is estimated that 20% of people undergoing medical review are men. If a random sample of 100 people is undergoing medical review, find the probability that more than 30 are men. [5]

NOV 2011

17. The number of patients admitted at a medical centre each day is found to have a Poisson distribution with mean 2.

a) Evaluate the probability that on a particular day there will be no admission [2]

b) At the beginning of one day, the hospital have 5 beds available. Calculate the probability that this will be an insufficient number for the day. [5]

c) Calculate the probability that there will be exactly three admissions altogether on two consecutive days. [3]

d) 150 patients are attended to, at the centre on one particular day the probability that a patient will be admitted is 0,02. Using a suitable approximation, find the probability that exactly 4 patients are admitted. [3]

NOV 2011

18. In an Olympiad Quiz Examination paper, there are 100 questions. Each question has 5 suggested answers and a candidate has to choose the correct one. Given that Mary is equally likely to choose any of the 5 answers in each question since she was guessing, use a suitable approximation to find the probability that she get at least 27 correct answers. [4]

NOV 2013

19. In a certain factory, there are two machines producing the same brand of fuses. The first machine produces 10 % and the second machine produces 90 % of the fuses. It is known that the probability that the first machine produces a defective fuse is 1 % and the probability that the second machine produces a defective fuse is 5 %.

i) Find the probability that a fuse drawn at random from the production line is defective. [2]

ii) Given that fuse is defective, find the probability that it was produced by the first machine. [3]

NOV 2013

20. The number of people joining a queue in a supermarket between 6.30 am and 7.00 am on a week day follows a Poisson distribution with mean of 2 people joining the queue per minute. Find the probability that

a) Five people join the queue in one minute, [2]

b) more than four people join the queue in one minute [3]

c) less than four people join the queue in a 2 minute interval. [4]

NOV 2013

21. Every year a local cellular network provider holds a competition. The proportion that a dollar spent on airtime wins a prize is 1 in 110.

a) Show that the probability that a subscriber who spent \$50 on airtime wins at least one price is 0,365 correct to 3 significant figures. [3]

b) Find the probability that in a group of

i) 10 subscribers each spending \$50 on airtime, 3 or more win at least one prize,

ii) 100 subscribers each spending \$50 on airtime, 40 or more win at least one prize.

NOV 2013 [8]

22. The probability that a learner driver passes his/her test at Vehicle Inspection Department is. A learner counts the number of attempts, n until he/she passes the driving test,

a) State a suitable statistical distribution which can be used to model the above situation. [1]

b) Find the mean and variance of the distribution. [3]

c) Find the smallest value of n, for which there is a probability of at least 0.7, that the learner need only n or fewer trials to pass the test. [4]

JUN 2013

23.Mangoes are boxed into cartons, each containing 500 mangoes. The probability that a mango is rotten is 0,002. Buyers of these cartons of mangoes will return any carton that contain 4 or more rotten mangoes.

a) i) Find the expected number of rotten mangoes per carton. [1]

ii) State, giving a reason, the most appropriate statistical distribution which can be used to model the above situation. [2]

b) Find the probability that i) a carton of mangoes is not returned, ii) if two cartons of mangoes are chosen at random, they contain at least three rotten mangoes. [7]

JUN 2013

24.The probability that a boy hits a target is 0.8. Assuming that shots are independent of each other and suppose that during each practice period, the boy fires shots until he hits the target.

(i) Find the mean and standard deviation of the number of shots fired per practice period. [3]

ii) Find the probability that the boy will need to take at least five shots to hit the target. [2]

JUN 2014

25.The probability that a seed is grown under specified conditions will germinate and produce a plant is 0.8. The minimum number of seeds, *n*, are to be planted under three conditions to ensure that a probability of at least 0.9 that 60 or more seeds will germinate and produce a plant.

(i) Using a suitable approximation show that $n^2 - 149.2 + 5531.6 \geq 0$ [4]

ii) 1. Solve the inequality in part i). 2. Hence or otherwise find the minimum value of *n*, the number of seeds to be planted. [3]

JUN 2014

26.An insurance company receives on average 3 claims on any given week. Find the probability that the company receives

(a) at least 2 claims in any given week, [3]

(b) one claim a day, assuming that the company works 5 days in a week, [3]

(c) a total of 2 claims during 3 consecutive weeks, [3]

(d) at least 2 claims in exactly one of the 3 consecutive weeks. [3]

JUN 2015

27.The number of passengers arriving at a taxi rank per hour was found to have a Poisson distribution with mean 2.

a) Calculate the probability that in a particular hour there will be no passenger arriving. [2]

b) At the beginning of an hour there will be 4 taxis available for hire. Calculate the probability that this will be an insufficient for the hour assuming that each taxi allows only one passenger. [3]

c) Calculate the probability that there will be exactly 2 passengers arriving in 2 consecutive hours. ***JUN 2016*** [3]

28.a) i) State the conditions under which the normal distribution can be used as an approximation to the binomial distribution.

ii) A fair coin is tossed 100 times. By using a suitable approximation calculate the probability that the number of heads obtained is less than 37. [7]

b) 200 such coins in aii) are tossed each 100 times. By using another suitable approximation, find the probability that less than 37 heads are obtained more than 3 times. [5]

JUN 2016

29.It is known that 75% of customers visiting a cellular phone shop make a purchase.

(a) Calculate the probability that out of 14 randomly chosen customers, at least 12 make a purchase. [3]

(b) Find the least possible number of customers visiting the shop, given that the probability of them all making a purchase is less than 0.05. [4]

NOV 2017

30.a) On average there are 2 errors on a typed page of a certain document. Find the probability that there are

i) 3 errors on the first page,

ii) 5 errors on the first two pages. [6]

b) i) State the condition under which the Poisson distribution can be used as an approximation to the Binomial. [2]

ii) It is known that 2% of the population of a certain nation has epilepsy. 60 people are chosen at random from this nation. By using a suitable approximation, find the probability that there are 2 cases of epilepsy among them. [3]

NOV 2017

31.Given that X is a discrete random variable such that X ~Geo(0,4), find

a) $P(X \leq 7)$ [2]

b) $P(X > 8/X > 3)$ [3]

JUN 2017

32.A survey on 2 000 students at a certain university has shown that on average one in every 500 students at the university catches a cold in a week. Use a suitable approximation to find the probability that

a) Exactly one student catches a cold in a week. [2]

b) at least three students catch a cold in a month, assuming that the month has exactly 28 days. [3]

JUN 2017

33.a) State the condition under which the Poisson distribution can be used to approximate the Binomial distribution. [2]

b) Potato seeds are packed in packets each containing 200 seeds. On average 2% of the seeds in a packet are rotten. A packet containing 5 or more rotten potatoes is said to be substandard.

i) Calculate the probability that a packet of potato seeds is substandard. [3]
ii) A load consist of 20 randomly chosen packets of potato seeds. Find the probability that the load will consist of exactly 2 packets which are substandard. [3]

NOV 2018

34. In a certain school, 90% of the learners are right handed. Find the probability that in a random sample of

i) 8 learners, exactly 6 will be right handed. [3]
ii) 20 learners , fewer than 18 will be right handed. [4]
iii) 200 learners, at most 182 will be right handed. [4]

NOV 2018

35. A company receives on average 6 orders per day. Find the probability that

i) no more than 2 orders will be received on a given day. [3]
ii) on a given half day, no orders will be received. [3]

NOV 2018

36. 70% of all the cellphones sold by an electrical shop have a certain application.

(a) Find the probability that out 15 customers who buy a cellphone, less than 13 chose one with that application. [3]

(b) Use a suitable approximation to find the probability that, out of 60 customers who buy cellphones, more than 45 choose one with that application. [5]

NOV 2019

37. The number of people who use a lift in a multi-storey building follows a Poisson distribution with mean of 2 in a minute. Find the probability that

a) Exactly 3 people use the lift in a minute, [2]
b) less than 4 people use a lift in a period of 2 minutes, [3]
c) more than 2 people use a lift in 3 minute period. [3]

NOV 2019

38. a) The probability that a form 3 learner passes a given test at a particular school is 0.6.

i) In a class of 15 form 3 learners find the probability that 1. Exactly 4 learners pass the test, 2. Less than 13 learners pass the test. [6]
ii) In a stream of 200 form 3 learners, find the probability that more than 150 pass the test. [6]
b) if $X \sim Geo(0.25)$, calculate

i) the variance of X, [2]
ii) $P(X > 3)$. ***Nov 2019*** [2]

39. A school has two photocopiers X and Y, the number of times per week that X breaks down has a Poisson distribution with mean 0.3, while independently the

number of times that Y breaks down in a week follows a Poisson distribution with mean 0.2. Find the probability that in the next 4 weeks.

(i) X will not breakdown at all. [4]

(ii) There will be a total of 3 breaks down. [3]

(iii) Each photocopier will breakdown exactly twice. [3]

SPMN P 1

40. An insurance company receives on average 3 claims on any given week. Find the probability that the company receives

(a) at least 2 claims in any given week, [4]

(b) one claim in a day, assuming that the company works for 5 days in a week, [4]

(c) a total of 2 claims during 3 consecutive weeks, [4]

(d) at least 2 claims in exactly one of the 3 consecutive weeks. [4]

SPMN P2

CHI-SQUARED TEST

ZIMSEC PAST EXAM QUESTIONS

1. A random sample of men and women indicated their views on adopting a national dress as summarized below

	In favour	**Opposed**	**Undecided**	**Total**
Women	118	62	25	205
Men	84	78	37	199
Total	202	140	62	404

At the 1% level of significance, test the hypothesis that there is no difference in opinion between men and women in as far as this survey is concerned. [7]

Nov 2003

2. A sample of 250 seedlings growing in a nursery is classified for vigour and for leaf colour. The results are summarized in the following table.

	Vigour		
Leaf colour	**Good**	**Average**	**Weak**
Green	55	79	4
Yellow-green	11	60	15
Yellow	16	65	19

Test at the 5% level of significance whether vigour and leaf colour are related. [13]

Jun 2004

3. The table below shows the interruption of service per day due to a photocopying machine breakdown

Interruptions per day	0	1	2	3	4 or more
No of days	27	28	30	12	3

Test whether a Poisson distribution with parameter $\lambda = 1$is a suitable model at the 5 % significance level. [9]

Nov 2004

4. Most of the business done by an estate agent in Harare occurs during the months of March to October. The records for 1994 showed that the number of houses whose purchases were completed during these months were:

Month	M	A	M	J	J	A	S	O
Number of houses purchased	15	18	20	24	20	22	21	20

In allocating staff to deal with the work for 1995 the management worked on the assumption that no one of these is likely to be busier than another. At 5% level of significance, carry out a test to determine whether the assumption is justified. [9]

Nov 2007

5. In a seed viability test, 600 seeds were planted in rows of 6.The number of seeds that germinated in each row was counted and the results are shown in the table below.

Number of seeds germinating per row	0	1	2	3	4	5	6
Observed number of rows	1	4	7	29	33	18	8

(a) Calculate

(i) the mean of seeds germinating per row, [2]

(ii) the expected frequencies corresponding to these observed values for a binomial distribution with the same mean as that in (i) [5]

(b) Carry out the appropriate χ^2 – test, at the 5% level of significance, to determine whether the observed values confirm that the number of seeds germinating follow a binomial distribution. [10]

Nov 2008

6. The personnel department of a company in Chegutu is doing a study about job satisfaction, classifying it as either high, medium or low. A random sample of 310 employees was given a test designed to diagnose the level of job satisfaction. Results were recorded according to salary levels.

Job satisfaction	**Number of employees earning under \$10 million**	**Number of employees earning \$10-\$20 million**	**Number of employees earning over \$20 million**
High	20	20	10
Medium	100	65	35
Low	40	15	5

Use a χ^2 - test to determine if salary and job satisfaction are independent at the 5% level of significance. [13]

Jun 2008

7. A random sample of 400 students was asked to indicate their view on the infusion of environmental issues in their college curriculum. The results are summarised in the following table.

	In favour	**Opposed**	**Undecided**
Females	115	60	36
Males	90	85	14

Test at 5% level of significance the hypothesis that there is no difference between the males and the females. [7]

Nov 2009

8. The number of computers breakdowns per months at a University were observed over period of 100 months and summarised in the table below.

Breakdowns (X)	0	1	2	3	4	5 or more
Frequency	15	25	30	21	9	0

Test the hypothesis that X has a Poisson distribution. [12]

Nov 2009

9. The number of electrical faults at a station as observed over a period of 160m days. The following table gives the frequency distribution of the observations.

Number of electrical faults	0	1	2	3	4	5	6	7
Number of days	25	35	35	25	20	10	7	3

Apply the χ^2-test at the 5 % level of significance to determine if the number of electrical faults follows a Poisson distribution. [15]

Nov 2010

10. A sports director wants to know whether the interest distribution of form one students in sporting disciplines is different from form two interest distribution. The form two interest distribution is given in table 1

Table 1

Sporting discipline	**Percentage**
Cricket	21.1

Hockey	27.0
Rugby	33.9
Soccer	18.0

A random sample of 200 form ones was taken and gave the results in table 2

Table 2

Sporting discipline	**Frequency**
Cricket	42
Hockey	62
Rugby	64
Soccer	32

Show, at 5 % level of significance, whether the data provide sufficient evidence to conclude that the current form one interests are different from form two interest distribution. [13]

Nov 2011

11. The table gives the frequency distribution of the number of boys in 100 families each with 4 children.

Number of boys	0	1	2	3	4
Number of families	10	24	35	22	9

(a) Calculate the mean number of boys in a family. [2]

(b) Test, at 5% level of significance, whether the observed frequencies follow a binomial distribution. [14]

Nov 2013

12. The following data shows ownership of satellite dishes by different social classes in a randomly chosen sample of 150 households in a town.

Social class	**number of people who own satellite dishes**	**Number of those without a satellite dish**
Executive	15	10
Managerial	23	8
Working	54	40

Test at 5 % level of significance to establish if there is an association between ownership of a satellite dish and social class in the town. [11]

Jun 2013

13. A coin is tossed 5 times. Use a binomial test, at 5% level of significance, to test whether the coin is biased towards heads if at least 4 heads are obtained. [5]

Jun 2014.

14. A policemen attending to accidents claims that the type of an accident depends on the colour of car involved. The table below shows the results of 200 accidents attended to.

	Minor	**Serious**	**Fatal**	**Total**
Black	15	23	22	60
White	35	24	11	70
Red	20	23	27	70
Total	70	70	60	200

Test at the 10 % level of significance whether the data supports the policemen's claim. [11]

Jun 2014

15. One hundred Electrical components are tested to see how many defects each has. The results
are shown in the table.

Number of defects	0	1	2	3	4	5	6	≥7
Number of components	11	22	26	24	9	5	3	0

(i) Calculate the mean of the distribution. [2]

(ii) Calculate the expected frequencies (correct to 1 d.p) of the associated Poisson distribution having the same mean. [3]

(iii) Perform a χ^2 goodness of fit test to determine whether or not the above data come from Poisson distribution using 5 % level of significance. [9]

Jun 2014

16. The number of electrical faults at a station as observed over a period of 160m days. The following table gives the frequency distribution of the observations.

Number of electrical faults	0	1	2	3	4	5	6	7
Number of days	25	35	35	25	20	10	7	3

Apply the χ^2-test at the 5 % level of significance to determine if the number of electrical faults follows a Poisson distribution. [15]

Nov 2014

17. A survey on newspaper reading was carried out in 3 provinces. The results are shown in the table below

	Type of newspaper read

Province	TODAY	CURRENT	NEWS
Northern	55	65	30
Central	80	48	62
Southern	75	47	98

Test at 5 % level of significance whether there is an association between the province and newspaper preference. [12]

Jun 2015

18. The maximum heights cleared by 100 male athletes who took part in a high jump competition are shown in the table below.

Height, h,(cm)	Frequency
$161 < h \leq 165$	4
$165 < h \leq 170$	18
$170 < h \leq 175$	37
$175 < h \leq 180$	26
$180 < h \leq 185$	10
$185 < h \leq 190$	5

(a) Find the

(i) mean,

(ii) variance.

(iii) The expected frequencies for a Normal distribution having the same mean and variance as data in a) are given in the table.

Height, h,(cm)	Observed frequency	Expected frequency
$161 < h \leq 165$	4	3.73
$165 < h \leq 170$	18	16.00
$170 < h \leq 175$	37	31.11
$175 < h \leq 180$	26	X
$180 < h \leq 185$	10	Y
$185 < h \leq 190$	5	Z

Calculate the expected frequencies x, y and z. [7]

b) Test the goodness of fit using a 5 % level of significance. [10]

Jun 2016

19. It is assumed that there is an association between age of a learner driver and passing a driving test at first attempt. An analysis of 200 cases gave the following results

	Age in years			
	17	**18**	**19**	**20**
Fail	21	33	25	10
Pass	24	28	50	9

Test at 5% significance level whether there is an association between the age of a learner and passing at first attempt. [10]

Nov 2017

20. The discrete random variable X is distributed as shown in the table below

X	0	1	2	3	4
Frequency	46	44	20	8	2

(a) Calculate the mean value of X. [1]

(b) (i) Find the frequencies that would correspond to a Poisson model with the same mean.

ii) Test at the 5% level of significance whether the data follows a Poisson distribution with the same mean. [9]

Jun 2017

21. An agriculture class decided to test three new types of fertilizer, X, Y and Z on the bean crop in the school garden. They applied the fertilisers to 75 beds of bean plants. The yield per bed of beans was classified as high, medium or low. The results are summarised in the table below.

	Type of fertilizer		
Yield	X	Y	Z
High	12	15	3
Medium	8	8	8
Low	5	7	9

Test at the 1% level of significance whether there is association between type of fertiliser and yield. [11]

Jun 2017

DATA REPRESENTATION

ZIMSEC PAST EXAM QUESTIONS

1. Twenty-three people in a random sample were asked to record the number of kilometers they traveled by bus in a given week. The distances to the nearest kilometer are shown below.

67	76	85	42	93	48	93	46	52	63
82	72	44	66	87	78	47	66	50	72
82	56	58							

(a) Construct a stem and leaf diagram to represent this data. [2]
(b) Using a scale of 2 cm to represent 10 km draw a box and whisker plot to represent this data. [4]
(c) Give one advantage of using
(i) a stem and leaf diagram. [1]
(ii) a box and whisker plot. [1]

Nov 2003

2. The heights of 100 plants in a garden measured to the nearest centimetre are summarized in the following table.

Height (cm)	0-50	51-100	101-150	151-200	201-300	301-400
Frequecny	3	11	22	44	16	4

(a) Draw a cumulative frequency curve for the distribution using 2cm to represent 50 cm on the horizontal axis and 2 cm to represent 10 plants on the vertical axis. [4]
(b) The heights of the shortest and the tallest plants were 20 cm and 380 cm respectively. Use this information and your answer in (a) above to draw a box and whisker plot for the data. [5]
(c) Name a way of representing data so that the details of the original data are retained. [1]

Jun 2004

3. The masses in grams of 24 sweets in a bag are represented by the stem and leaf diagram shown below. The leaves are not ordered.

Stem	**Leaf**
0.7	2 3 9
0.8	0 8
0.9	1 9 1 8 4
1.0	3 8 6 1
1.1	3 3 9 3
1.2	1 2
1.3	9 3
1.4	4 5

Key: 0.7|2=0.72

(a) Find
   (i) the median of this distribution, [1]
   (ii) the mode of the distribution. [1]

(b) A sweet of mass more than 1.2g is classified as large. Calculate the mean of large sweets that the bag contains. [2]

Jun 2008

4. The stem and leaf diagram below shows the pocket money received by a group of girls in the year 1980

Stem	Leaf
0	50 50 50 75
1	00 00 00 50 75
2	00 00 00 50 50
3	00 25 30 75
4	50
5	50

Key 3|30 = $3.30

Find the mean and standard deviation of the distribution of the pocket money received by the girls. [3]

Nov 2008

5. The table shows the bus fares in thousands of dollars paid by 19 football fans selected at random from a football crowd.

73	**85**	**48**	**80**	**53**	**75**	**55**
58	**62**	**69**	**63**	**64**	**73**	**65**
55	**54**	**55**	**45**	**55**		

(a) Construct a stem and leaf diagram representing this data. [3]

(b) Calculate the median and inter-quartile range. [4]

Nov 2009

6. The following table gives the frequency distribution of the number of computers sold during the past months at all different computer stores in Harare.

Computers sold	50-52	53-55	56-58	59-61	62-64
Number of stores	5	10	21	8	6

(a) State the number of stores that sold the computers. [1]
(b) Calculate the mean. [3]
(c) Draw the cumulative frequency curve and hence estimate the
    (i) median
    (ii) quartiles. [6]
(d) Comment on the nature of the distribution. [1]

Nov 2010

7. The following are television prices in dollars taken in 40 different shops

40	130	170	240	360	520	170	130
240	360	520	120	220	170	330	480
160	290	200	120	480	160	210	330
70	140	180	260	370	90	150	200
280	450	80	420	190	140	270	120

(i) Construct a stem and leaf diagram for the data. [3]
(ii) Find 1. the median,
    2. the quartiles. [2]
(iii) Draw a box and whisker plot. [2]

Jun 2014

8. The marks obtained by candidates in a mathematics examination were displayed as follows:

1	3
2	6
3	1
4	1 3
5	0 2 6 8
6	1 2 2 2 7
7	0 3 4 5 5 8 9
8	0 3 4 4 8
9	2 7 7 8

Key 4|1 means 41%

(a) (i) State the name given to this display,

(ii) Calculate the range of the marks. [2]

(b) Comment on the skewness of the distribution. [1]

(c) State any one advantage of this type of display of information. [1]

Jun 2015

9. The stem and leaf diagram shows the number of hectares owned by farmers around a small town.

Stem	Leaf
0	1 4 7
1	1 3 8 9
2	0 1 2 4 7 8
3	0 0 2 3 4 5 7
4	7
	2 3 5 7

Key 1|3 means 13 hectares

(a) Find the

(i) median,

(ii) interquartile range. [4]

(b) Hence draw a box and whisker plot to illustrate the above information. [2]

Jun 2016

10.(a) State any one advantage and any one disadvantage of using a stem and leaf diagram as a method of representing data. [2]

b) A group of 30 students had their heights measured correct to the nearest centimetre. The results are shown below.

167	174	156	180	162	169	177	154	165	174
160	184	169	179	151	163	173	148	171	168
158	158	167	166	149	153	171	162	182	162

(i) Using five stems, plot a stem and leaf diagram for the above information. [3]

(ii) Find the median. [1]

(iii) Find the inter-quartile range. [3]

Nov 2017

11.Below are marks obtained by a group of 36 advanced level students of a certain school in Mathematics test.

59	53	74	55	90	57	88	68	59	67	82	62
61	77	74	86	60	83	92	58	60	72	57	96
56	67	73	78	66	79	51	60	54	67	80	63

(a) Construct a stem and leaf diagram to illustrate the distribution of the marks, such that each interval has a width of 5 marks. [3]

(b) Find the

(i) median mark, [1]

(ii) inter-quartile range. [2]

Jun 2017

12. The heights (cm) of 15 children were measured and the results shown below

115 120 158 132 125 104 142 160 145 104 162 117 107 124 134

(a) Draw a stem and leaf diagram to represent the heights

(b) Find the

(i) Median [3]

(ii) Quartiles of the heights [3]

(c) (i) Using a scale of 2cm to represent 2cm to represent a height of 10cm, draw a box and whisker plot for the data. [2]

(ii) Comment on the distribution of these heights. [1]

Nov 2018

CONTINUOUS RANDOM VARIABLE

ZIMSEC PAST EXAM QUESTIONS

1. A Domestic Workers Union claims that the average hourly rate paid to domestic workers is $15.85. The house-wives league in this country wishes to test this claim. They conducted a survey amongst a sample of 1 225 domestic workers throughout the country. They found the sample mean hourly rate to be $16.03. Assume that the population standard deviation of hourly rates paid to domestic workers is $2.87. Test the hypothesis at the 2% significance level that the average hourly rate paid to domestic workers in this country is more than $15.85. [6]

Nov 2003

2. It is given that about 95% of values of a standard normal distribution lie between a and b. where a < b and P(a < x < b) = 0.95.
   (i) Show that $b = \mu + 1.96\sigma$ and $a = \mu - 1.96\sigma$. [5]
   (ii) Hence show that $\mu = \frac{a+b}{2}$ [2]

Nov 2003

3. On any day, the amount of time measured in hours, that a viewer spends watching television is a continuous random variable T, with a cumulative distribution function given by

$$F(t) = \begin{cases} 0 & t \leq 0 \\ 1 - k(15-t)^2 & 0 \leq t \leq 15 \\ 1 & t \geq 15 \end{cases}$$

Where k is a constant.

(i) Show that $k = \frac{1}{225}$. [2]

(ii) Show that for $0 \leq t \leq 15$, the probability density function of T is given by $f(t) = \frac{2}{15} - \frac{2}{225}$ [2]

(iii) Find the median of T. [3]

Nov 2003

4. Biscuits are produced with weight W grams where W – N (10:4) and are packed at random into boxes consisting of 25 biscuits. Find the probability that
   (a) a biscuit chosen at random weights less than 9.5g. [2]

(b) the contents of a box weigh between 247g and 253 g. [3]
(c) the mean weight of the biscuits in the box is greater than 10.2g. [3]

Nov 2003

5. The difference between the actual and the scheduled time arrival for a commuter train is normally distributed with a mean of 5 minutes (ie on average it is 5 minutes late) and standard deviation of 11 minutes. On a randomly chosen day, calculate the probability that the train will be
   (i) more than 5 minutes late [2]
   (ii) late [3]
   (iii) at least 10 minutes late [2]

Jun 2004

6. the probability density function of a life time, X hours of a bulb is given by

$$f(x) = \begin{cases} kCox\left(\frac{\pi}{200}\right) & , for\ 0 \le x \le 100 \\ 0 \quad elsewhere & \end{cases}$$

   (i) show that k=$\left(\frac{\pi}{200}\right)$ [2]
   (ii) find E(X) [3]
   (iii) Find the probability that a bulb chosen at random will have a lifetime exceeding 80 hours. [3]

Jun 2004

7. A number X is randomly selected from the interval (-л, л). Find the cumulative distribution function of X. [4]

Nov 2004

8. The function $f(x) = \begin{cases} \frac{2}{3x(2-x)}, & 0 \le x \le 1 \\ 0, & \text{otherwise.} \end{cases}$
   (i) Verify that f(x) is a probability density function. [2]
   (ii) Find $P(X < ½)$ [1]
   (iii) Calculate the probability that 2 of 3 independent values of X observed will be less than ½ [3]

Nov 2004

9. (a) Mercy travels from her Harare office to her home by commuter omnibus from station A to station B. her walking times to station A from the office and from station B to her home add up to 20 minutes. The variable factors measured in minutes are as shown in the table below

	Mean	Standard deviation
Waiting time	30	54
Bus journey	50	25

Assuming that these two factors are independent and normally distributed, find the probability that the whole journey takes

(i) less than 88 minutes, [5]

(ii) between 94 and 102 minutes. [3]

(b) Tendai and Chipo make typographical errors on average at a rate of 0.4 and 0.6 per page respectively. The two are asked to type end of term examinations for English Language. Given that the examinations consists of 10 typewritten pages each, find the probability that

(i) Tendai will make at most 2 errors, [3]

(ii) the total errors made by the two are more than 2. [4]

Nov 2004

10. A company in Gweru uses two machines, A and B, to manufacture steel rods whose lengths are normally distributed. The table below gives the distribution of the steel rods from the two machines.

Machine	Mean	Variance
A	15	0,5
B	16	0,1

If two rods are selected at random from the production of each machine, find

(i) the mean and variance of their combined length for each machine. [4]

(ii) the probability that the total lengths of the rods from machine B is greater than the total lengths of rods from machine A. [4]

Nov 2008

11. The diameters of 25 steel rods are found to have a mean of 0,980 cm and a standard deviation of 0,015 cm. Assuming that the diameters of the steel rods are normally distributed with the same variance, find 99% confidence limits for the population mean. [4]

Jun 2008

12. Independent continuous variables X and Y have probability density functions

$f(x) = \begin{cases} \frac{1}{4}x, & 1 \leq x \leq 3 \\ 0, & otherwise \end{cases}$ and $g(y) = \begin{cases} \frac{1}{2}, & 2 \leq y \leq 4 \\ 0, & otherwise \end{cases}$ respectively.

(i) Find the expectation and variance of X and Y. [9]

(ii) Hence calculate the expectation and variance of 4Y-3X to 2 decimal places.

Jun 2008 [4]

13. The duration X minutes of a telephone call by a school head to the Provincial Education Director is a continuous random variable with a probability density function given by

$$f(x) = \begin{cases} x^{-2}, & x \geq 0 \\ 0, & otherwise. \end{cases}$$

Given that a call has already lasted for 5 minutes , find the conditional probability that its total duration will be less than 7 minutes. [7]

Nov 2009

14. A continuous random variable has a probability density function,

$$f(x) = \begin{cases} kx, & 0 \le x \le 3 \\ 3k(4-x), & 3 \le x \le 4 \\ 0, & otherwise \end{cases}$$

where k is a constant.

a) Find the value of k, and sketch the graph of f(x). [4]

b) Find the probability that x > 2. [3]

Nov 2010

15. After some rain the depth of moisture, X meters, in Arda Gardens can be taken as a continuous random variable with a probability density function

$$f(x) = \begin{cases} \frac{12x}{5}(b-x), & 0 \le x \le 1 \\ 0, & otherwise \end{cases}$$

a) Find the value of b. [3]

b) Calculate the probability that the depth of moisture exceeds 0,9. [3]

Nov 2014

16. The probability density function of the lifespan, X months, of a bulb is given by

$$f(x) = \begin{cases} \frac{k}{x(4-x)}, & 1 \le x \le 3 \\ 0, & otherwise \end{cases}$$

a) Find the value of k. [3]

b) Given that E(X) = 2, show that Var(X) = $4-\frac{4}{1n3}$ [3]

c) Find the probability that a bulb chosen at random will have a lifespan exceeding 2 months. [2]

Nov 2013

17. A continuous random variable has a probability density function f(x) given below

$$f(x) = \begin{cases} \frac{1}{2}, & 0 \le x \le 0.5 \\ \frac{1}{5}(3-x), & 0.5 \le x \le 3 \\ 0, & otherwise \end{cases}$$

a) Sketch the graph of f(x). [2]

b) Find the median. [3]

c) Evaluate P(x<1.2). [3]

Jun 2013

18. A continuous random variable, X, has a probability density function defined as

$$f(x) = \begin{cases} 0.1x + k, & 4 \le x \le 6 \\ 0.3, & 6 \le x \le 8 \\ 0, & otherwise \end{cases}$$

Find

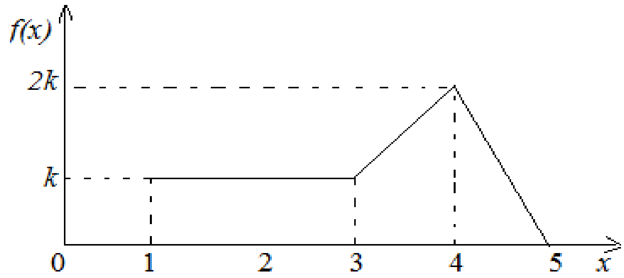
a) The value of the constant k, [2]
b) P(5≤X≤7). [2]

Jun 2015

19. The Diameter of washers produced by a particular machine follow a normal distribution with a standard deviation of 0,1mm. Find the mean diameter if there is to be a probability of only 3% that the diameter exceeds 2.0mm. [4]

Jun 2016

20. A continuous random variable X has a probability density function f(x) given by $f(x) = 0$ for $x < 1$ and for $x > 5$. For x between 1 and 5, its form is shown on the graph.



a) Show that $= \frac{2}{9}$. [2]
b)Construct the probability density function of X. [2]

Jun 2016

21. A continuous random variable X has probability density function f(x) given by

$$f(x) = \begin{cases} 2\left(\frac{a-x}{a^2}\right) & , \ 0 \le x \le a \\ 0 \ \ otherwise & \end{cases}$$ where *a* is a constant

a) Find E(X) in terms of a. [2]
b) Show that the expression for the median reduces to $2m^2-4am+a^2=0$ where *m* is the median. [3]

Nov 2017

22. The random variable X is normally distributed with mean μ and standard deviation σ. Given that $P(X > 3.6) = 0.5$ and $P(X > 2.8) = 0.6554$, find the value of μ and the value of σ. [5]

Nov 2017

23. The continuous random variable X has a probability density function given by

$$f(x) = \begin{cases} 2e^{-kx}, & x \ge 0 \\ 0, & x < 0 \end{cases}$$ where k is an integer,

a) Show that k = 2. [2]
b) Find the i) cumulative function of X, [2]
ii) exact value of the median. [2]

Jun 2017

24. The random variable X is normally distributed with mean μ and variance σ^2. Given that $P(X > 65) = 0.01$ and P(X<20) = 0.02, find μ and σ. [7]

Jun 2017

LINEAR COMBINATION OF RANDOM VARIABLES

ZIMSEC PAST EXAM PAPERS

1. The independent random variables X and Y are such that $X \sim N(24; 25)$ and $Y \sim N(40; 36)$
   (a) Find (i) $E(2X - 3Y)$ [1]
   (ii) $Var(2X - 3Y)$ [2]
   (b) State the distribution that the random variable 2X-3Y follow. [1]

Nov 2004

2. A random variable X has $E(X) = 10$ and $Var(X) = 9$. Find the expected value and variance of $Y = 2X - 3$. [4]

Nov 2009

3. X and Y are two independent random variables whose means and variances are shown in the table below.

	Mean	Variance
X	20	9
Y	10	4

The random variable Z is defined by $+ bY$, where a and b are integers, has a mean of 20 and a variance of 145. Find the values of a and b. [7]

Nov 2010

4. Boxes marked B contain big fruits and boxes marked S contains small fruits. The masses of the boxes are continuous random variables having independent normal distributions with means and standard deviations given in the table below,

Size of fruit	**Mean mass of a box(kg)**	**Standard deviation(kg)**
Big	10	2
Small	112	2

(a) Find the probability that the mass of
   (i) a box marked S is less than 10kg,
   (ii) 4 big fruits boxes and 5 small fruit boxes is greater than 90 kg. [7]

(b) Find the value m such that $P(B1 + B2 < m) = \frac{1}{4}$ where B_1 and B_2 are independent observations. [7]

Nov 2014

5. The length and height of a brick are independent normal variables with means and standard deviations as shown in the table.

	Length (mm)	Height (mm)
Mean	198	98
Standard deviation	1	1

(a) Find the probability that
   (i) the sum of the length of five randomly chosen bricks exceeds 994 mm,
   (ii) the height of a randomly chosen brick is less than one half of the length .
[7]

(b) L denotes the sum of the lengths of 40 randomly chosen bricks and H denotes the sum of heights of 75 randomly chosen bricks. Find mean and variance of L-H. [4]

Nov 2013

6. The following data shows ownership of satellite dishes by different social classes in a randomly chosen sample of 150 households in a town.

Social class	number of people who own satellite dishes	Number of those without a satellite dish
Executive	15	10
Managerial	23	8
Working	54	40

Test at 5 % level of significance to establish if there is an association between ownership of a satellite dish and social class in the town. [11]

Jun 2013

7. The switchboard of a small company handles both incoming and outgoing telephone calls. During lunch hour on any day, the numbers of incoming and outgoing calls are independent and have a Poisson distribution with parameters 5 and 3 respectively. Find the probability that during lunch hour of a randomly chosen day, there will be
   (i) exactly 3 outgoing calls, [2]
   (ii) at least 6 incoming calls, [2]
   (iii) a combined number of 3 calls through the switchboard. [3]

Jun 2014

8. A manufacturer of vehicles sells two types of vehicles, heavy and light vehicles. The cost of each type of vehicle in thousands dollars are shown in the table below.

	Mean cost	**Standard deviation**
Light	252	2
Heavy	1 012	5

(i) A vehicle of each type is selected at random. Find the probability that the heavy vehicle costs less than 4 times the light vehicle. [5]

(ii) One heavy and four light vehicles are selected at random. Find the probability that the cost of a heavy vehicle is less than th total cost of four light vehicles.[5]

Jun 2014

9. The mass, mg, of a randomly chosen key-holder is known to follow a normal distribution with mean 20g and a standard deviation of 4g. The mass M grams of a randomly chosen key-holder is also known to follow a normal distribution with mean of 12 g and standard deviation of 9 grams.

(a) Find the probability that the combined mass of

(i) 2 randomly chosen key-holders and 3 randomly chosen keys is greater than 78g,

(ii) 3 key-holders is greater than the combined mass of 6 keys. [8]

(b) Determine the probability that a randomly chosen key-holder is more than twice the mass of a randomly chosen key. [5]

Jun 2015

10. The masses, in grams, of the contents and packaging of a randomly chosen packet of powdered milk of brand M may be taken to have a normal distribution with mean and standard deviation given in the table.

	Mean	Standard deviation
Contents	500	8
Packaging	20	2

(a) The probability that

(i) a randomly chosen packet of brand M has a total mass exceeding 525 grams.

(ii) the total weight of the contents of three randomly chosen packets of brand M exceeds 1 515 grams. [9]

(b) The masses of the contents of a randomly chosen packet of another brand N may be taken to have a normal distribution with mean 405 grams and standard deviation 6 grams. Find the probability that the contents of 5 randomly chosen packets brand N weighs more than the contents of four randomly chosen packets of brand M. [5]

Jun 2016

11.(a) State any one advantage and any one disadvantage of using a stem and leaf diagram as a method of representing data. [2]

(c) A group of 30 students had their heights measured correct to the nearest centimeter. The results are shown below.

167	174	156	180	162	169	177	154	165	174
160	184	169	179	151	163	173	148	171	168
158	158	167	166	149	153	171	162	182	162

(i) Using five stems, plot a stem and leaf diagram for the above information. [3]

(ii) Find the median. [1]

(iii) Find the inter-quartile range. [3]

Nov 2017

12.The random variables, R and S, are normally distributed . Given that $R \sim N(54,36)$ and $S \sim N(48,25)$

(a) Find

(i) the value of r and s such that $P(R \leq r) = P(S \geq s) = 0.484$. [7]

(ii) $P(R \geq S)$ [2]

(b) Six independent observations of R are taken. Find the probability that the sum of six observations is less than 300. [5]

Jun 2017

PROBABILITY AND DISCRETE RANDOM VARIABLE

ZIMSEC PAST EXAM QUESTIONS

1. a) If E1 and E2 are any two events, explain what is meant by
   (i) E1 and E2 are independent. [1]
   (ii) E1 and E2 are mutually exclusive. [1]
   (b) In the who, what or where game, three contestants each chooses one of the three categories of a question. Assuming that the contestants choose independently and that they are equally likely to select any of the categories, find the probability that
   (i) All will choose different categories. [3]
   (ii) Two will be alike and the third different. [4]

   Nov 2003

2. A box contains 3 fuses, two defective and one good. Two fuses are drawn in sequence without replacement. Calculate the probability that
   a) The second fuse drawn is defective [3]
   b) The second fuse drawn is defective, given that the first is defective.
   [4]

   Jun 2004

3. The random variable X is defined as the remainder when the set $Y = \{20; 21; 22 \ldots \ldots \ldots \ldots \ldots .. 29\}$ is divided by 3
   (a) Write down the values of X [1]
   (b) Draw a probability distribution table [2]
   (c) Find (i) $E(X)$ [2]
   (ii) $Var(X)$ [3]

   Jun 2004

4. A university students visits the National Free library frequently. On each visit she records the numbers of people in the que at the check point. The table below shows the record of randomly chosen visits.

Number of people	4	5	6	7	8	9
Number of visits	2	3	7	6	4	2

Calculate the mean and standard deviation of the people in the queue [3]

Nov 2004

5. Three flower vendors X, Y and Z have equal chances of selling their flowers. X has 80 red and 20 white, Y has 30 red and 40 white and Z has 10 red and 60 white flowers. On Valentine's Day, Kudzai wants to buy a flower.
   (i) Find the probability that she picks a red flower [3]
   (ii) Given that she bought a red flower find the probability that it was from Y [3]

Nov 2004

6. An unbiased six sided die is thrown three times.
   Calculate the probability that
   (i) The total score is an even number, [2]
   (ii) The total score is an even number given that a 5 appears at the first throw.[4]

Jun 2005

7. A loaded die is such that the probability of the face turning up is proportional to the number of X on the face. The prbability distribution of the discrete random variable X is given in the table below.

x	1	2	3	4	5	6
$P(X=x)$	k	$2k$	$3k$	$4k$	$5k$	$6k$

(a) verify that $P(X=x)=\frac{2}{21}$ [2]

(b) given that $E(X)=\frac{13}{3}, find\ Var(X)$ [2]

Jun 2006

8. A biased die produces a score, Y, for which the probability distribution is given in the table below.

y	1	2	3	4	5	6
$P(Y=y)$	x	$2x$	$3x$	$4x$	$5x$	$6x$

(a) Find the value of x [2]

(b) Hence find
   (i) The mean
   (ii) The variance of the random variable Y [3]

Nov 2006

9. A bag contains 5 white balls and 3 red balls. Two players, A and B, take turns at drawing one bag from the bag at random, and balls are not replaced. The player who first gets two red balls is the winner, and the drawing stops as soon as either player has drawn two red balls. Player A draws first. Find the probability that player A is the winner given that the winning player wins on his second draw. [5]

Nov 2006

10. A building society gives both adjustable-rate mortgage and fixed-rate mortgages on residential property. It breaks residential property into 3 categories: low density houses, high density houses and blocks of flats. The following table gives probabilities appropriate to this situation.

	Low density	**High density**	**Blocks of flats**
Adjustable-rate	0.285	0.240	0.100
Fixed-rate	0.115	0.200	0.060

Find the probability that

(i) The building society gives a mortgage for a low density property, [1]

(ii) The building society gives a mortgage for a low density property to each of the four people who are first to apply, [2]

(iii) A mortgage is adjustable-rate given that it is for a low density prpoperty. [2]

Nov 2007

11. A manufacturing plant uses three machines in its production process. The total daily output contribution for machines A, B and C are 40%, 45% and 15% respectively. It is known that 4% of the tins produced by A are defective, 3% produced by B are defective and 1% produced by C are defective

(a) Calculate the probability that one tin chosen at random from the day's production is defective. [3]

(b) Given that a randomly chosen tin is defective, calculate the probability that it came from B. [2]

Jun 2004

12. It is given that $P(X = x) = k\left(\frac{1}{3}\right)^x$, $x = 1,2,3,4$ where k is a constant. Find

(i) The value of k, [2]

(ii) $P(X \leq 3)$, [2]

(iii) $E(X)$. [2]

Jun 2004

13. A roulette wheel contains 38 numbers of which 18 are red, 18 are black and 2 are green. When a roulette is spun, it is equally likely to land on any of the 38 numbers. In two plays at the wheel, find the probablility that
    (a) The ball lands on red both times [2]
    (b) The ball lands on green the first time and on black the second time. [2]

Nov 2011

14. The meteorological department of a certain country adopts a simple model of the weather in which each day is classified as either fine or rainy. The probability that a fine day is followed by another fine day is 0.8. The probability that a rainy day is followed by a fine day is 0.4. The probability that 1 February is fine is 0.75. Using a tree diagram or otherwise, find the probability that
    (a) The 3rd of February is fine, [3]
    (b) The 1st February was rainy given that 3rd February is fine [3]

Nov 2011

15. An unbiased tetrahedral die has the number 1 written on one face, the number 2 on the other face and the number 3 on the remaining two faces. The die is thrown twice and X is the product of the scores obtained from the two throws. Find
    (a) The probability distribution of X [4]
    (b) $E(X)$ and $Var(X)$ [4]

Nov 2011

16. In a certain court, there are only two verdicts on passing judgement, namely "convitded" or "discharged". Of all the cases that have been tried by this court, 80% of the verdicts were convictions. Suppose that when the court's verdict is "convicted" or "discharged", the respective probabilities of the accused person being innocent are 0.07 and 0.4 respectively.
    By the use of a tree diagram, find
    (a) The probability that a person tried by this court is innocent, [3]
    (b) The conditional probability that an innocent person tried by this court is convicted. [3]

Jun 2012

17. A die is weighed in such a way that the probability of each face coming up is proportional to the face value, x.
    (a) Construct the probability distribution of X [2]
    (b) Calculate E(X) [2]

Jun 2018

18. A school selects 55% of its lower sixth pupils from its own O level pupils and the remainder comes from other schools. It is established that 90% of accepted A-level students who did their O-level outside the school pass their A-level studies, and that 70% of those who did their O-level studies at the school pass their A-level

studies. A pupil is selected at random from the recent A-level graduate of the school. Find the probability that the pupil

(i) Passes A-level studies. [4]

(ii) Did O-level outside the school, given that the pupil passes A-level studies[2]

Nov 2008

19. A fair die is tossed three times. Find the probability that

(i) Exactly one six is obtained. [2]

(ii) The first score is even, the second is odd and the third is either a one or a two. [3]

Jun 2008

20. A discrete random variable X takes the values 0, 1 and 2 only, with probabilities P_0, P_1 and P_2 respectively. Find the values of P_0, P_1 and P_2 given $E(X) = \frac{4}{3}$ and $Var(X) = \frac{5}{9}$. [8]

Jun 2008

21. Three tickets for a musical show are sent to a high school musical club. Fifteen girls and ten boys would like a ticket. If the three people to receive a ticket are chosen at random, find the probability that they will be

(i) exactly 2 boys, [3]

(ii) at least 2 girls. [3]

Nov 2009

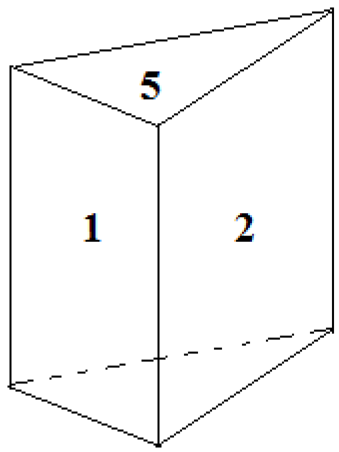
22. Three tickets for a musical show are sent to a high school musical club. Fifteen girls and ten boys would like a ticket. If the three people to receive a ticket are chosen at random, find the probability that they will be

(i) exactly 2 boys, [3]

(ii) at least 2 girls. [3]

Nov 2009

23. The diagram above shows a triangular prism with two equilateral triangular faces and three rectangular faces. The rectangular faces are numbered 1, 2 and 3 whilst the triangular faces are numbered 4 and 5. When the prism is tossed the probability that it lands on each rectangular face is $2k$ and the probability that it lands on each triangular face is k.



(a) Calculate the value of *k*, [2]

(b) Define X as the random variable "the number on which the prism lands."

(i) Show that $E(X) = 2\frac{5}{8}$ [3]

(ii) Find Var(X) [3]

Nov 2009

24. In a certain factory, there are two machines producing the same brand of fuses. The first machine produces 10 % and the second machine produces 90 % of the fuses. It is known that the probability that the first machine produces a defective fuse is 1 % and the probability that the second machine produces a defective fuse is 5 %.

(i) Find the probability that a fuse drawn at random from the production line is defective. [2]

(ii) Given that the fuse is defective, find the probability that it was produced by the first machine. [3]

Nov 2013

25. During the 2010 World Cup in a certain city, the probability that there was electricity on any particular day was $\frac{1}{3}$. In the case that there was no electricity, a generator would be switched on. Independently, the probability that john watched a soccer match being screened live was $\frac{1}{4}$.

(a) Represent the information by means of a tree diagram. [1]

(b) Given that John watched a soccer match, find the probability that there was no electricity. [3]

Jun 2013

26. A bag contains 24 counters of which 6 are red, 8 are green and 10 are yellow. The counters are taken from the bag at random without replacement.

(i) Show that the probability that 2 of the counters taken are green is $\frac{56}{253}$ [2]

(ii) Given that 2 of the counters are green, find the probability that the first counter taken is red. [3]

Jun 2014

27. The distribution table shows prizes corresponding to six values on a fair spinner used in a game. The spinner lands only on one of the six values.

Value	1	2	3	4	5	6
Prize in $	2	2	6	4	10	6

(a) Find the probability of the spinner landing on
  (i) a prime number,
  (ii) a value that gives a prize of not less than $4. [2]
(b) Calculate the expected prize for a single game. [2]

Jun 2015

28. Two tetrahedral dice with faces marked 0, 1, 2, 3 are thrown and the number on which each lands on is noted. The score is the sum of the 2 numbers. By means of an outcome table or otherwise, find the probability that
  (i) the score is a prime number, [3]
  (ii) one die lands on a 3 given that the score is a prime number. [3]

Jun 2015

29. Bag A contains 3 red balls and 2 white balls. Bag B contains 2 red balls and 3 white balls. A bag is selected at random and the two balls are drawn from it, one after the other without replacement.
  (a) Find the probability that the two balls drawn are red. [2]
  (b) Given that the two balls are red, find the probability that they are from bag [3]

Jun 2016

30. A and B play against each other in a game. Each result is either a win for A or a win for B. the probability of A winning the first game is 0.6. If A wins a particular game, the probability of winning the next game is 0.7. If A loses a particular game, the probability of winning the next game is 0.4. Find the probability that
  (i) A loses the second game, [2]
  (ii) A wins the first game, given that A loses the second game. [3]

Nov 2017

31. A random variable X, has the probability distribution given below.

X	0	1	2	3
P(X=x)	0.35	0.2	p	q

Given that $E(X^2) = 3$,
  (i) find the value of p and the value of q,
  (ii) Calculate the Var(X), correct to 2 decimal places. [7]

Nov 2017

REGRESSION:BIVARIATE DATA

ZIMSEC PAST EXAM PAPERS

1. The pressure P and volume V of a fixed mass of gas are related by an equation of the form
$PV^a = k$, where k and a are constants.
From this equation obtain a linear equation, $y = mx + c$, where $x = InP$ and $y = InV$. [2]

In six experiments of the fixed mass of a gas, in each of which P was controlled and V measured. The results satisfied

$\Sigma x = 2.420, \Sigma y = -1.708,$
$\Sigma x2 = 3.171, \Sigma y2 = 1.561,$
$\Sigma xy = -2.224.$

(a) Calculate the equation of the line of regression of y on x. [6]
(ii) Hence estimate, to 2 decimal places, the value of a. [2]
(b) Calculate the value of V correct to 3 significant figures when P= 0.75. [2]

Nov 2003

2. The IQs of a group of 6 students who sat for a mathematical examination were measured. Their IQs and examination marks were recorded

Person	***IQ***	***Examination mark***
A	110	70
B	100	60
C	140	80
D	120	60
E	80	10
F	90	20

(a) Construct a scatter graph of this data [2]
(b) Find the product moment correlation coefficient [4]
(c) Comment on the correlation between the IQ and the exam marks [1]

Jun 2004

3. Two dice were thrown and the sum of their scores doubled to give value X. at the same time a card was drawn at random from a normal pack of cards to give value Y. the table below shows the results.

Throw	**Dice(X)**	**Card(Y)**
1st	8	8
2nd	8	9
3rd	14	10
4th	22	5
5th	22	8
6th	16	3
7th	12	3
8th	c	2
9th	10	7
10th	10	5

(a) Given that the regression line Y on X is $y = 0.345x + 5.58$ where
$\sum x = 128 \sum Y = 60$
$\sum x^2 = 1928 \sum y^2 = 430$
$\sum xy = 778$

(i) Calculate the regression line x on y [4]
(ii) Using an appropriate equation, find the best estimate of the card value that would be associated with a dice value of 24. [2]

(b) Is your result in (a) (ii) reliable? Give a reason [2]

Jun 2004

4. ***For this question answers must be given correct to 3 significant figures where appropriate.***
   The yield per hectare of a crop depends on the amount of rainfall in the growing season. The value of the yield, X, in tones per hectare and the rainfall, Y, in centimeters per nine successive growing seasons are given in the table below

X	8	10	15	6	11	12	13	11	9
Y	14	10	18	13	14	13	16	11	12

$\Sigma X = 95, \Sigma X2 = 106l, \Sigma XY = 1307, \Sigma Y = 121$ *and* $\Sigma Y2 = 1675,$

(i) Find the product moment correlation coefficient. [2]

What does the value of the product moment correlation coefficient indicate about the yield and rainfall amount? [1]

(ii) Find the regression line of y on x. [5]

What does the value of the product moment correlation coefficient indicate about the relationship between the regression line of y on x and the regression line of x on y? [1]

Nov 2004

5. To investigate a chemical process used by a mining organization to extract a mineral for export, the amount x , of a chemical added to a mixture is varied and the concentration y, of the final product is noted. The results are as follows.

x(g)	10	10	15	15	20	20	25	25	30	30
y(%)	2.7	2.9	4.5	4.0	6.3	6.2	8.0	7.4	9.7	10.1

(a) Draw a scatter diagram of the data. [3]

(b) (i) Calculate the equation of the regression line y on x. [4]

ii) Draw the regression line on a scatter diagram. [2]

(c) i)State, giving reasons whether varying the amount of chemical added is an effective way of controlling the final concentration. [2]

ii) What advice would you give to the technical manager who requires the final concentration to be consistently in the range 3,5 to 4,5? [3]

Jun 2007

6. In each of the seven successive weeks, the number N, of road accidents between Harare and Chegutu, and the number P , of police cars on patrol are recorded. The results are shown in the table below:

P	2	3	4	4	5	6	6
N	45	40	36	42	30	25	24

(a) Plot these results on a scatter diagram. [3]

(b) Write down the coordinates of one point through which the regression line P on N must pass. [1]

(c) Calculate the regression line of P on N in the form P = $a + b$N. Draw this line on your graph and use it to estimate P when N = 35. [7]

(d) (i) Calculate the product moment correlation coefficient for the given data. [3]

ii) Interpret the result of this calculation in terms of your scatter diagram. [2]

Nov 2008

7. Participants to a ZIMSEC workshop on syllabus interpretation were asked to report the distance d, they drove in kilometers and the time t, taken in minutes. The table below gives a random sample of the values reported.

d(km)	263	211	290	580	473	377
t(min)	180	210	240	420	390	330

$$\sum(d-300)=394,\ \sum(d-300)^2=123\,648,\ \sum(t-200)=570,$$
$$\sum(t-200)^2=103\,500,\ \ \sum(d-300)(t-200)=103\,930$$

(a) Plot these data on a scatter diagram. Use a scale of 2 cm to represent 50 km on horizontal axis and 2 cm to represent 50 minutes on vertical axis. [3]

(b) Obtain the equation of the estimated regression line of t on d. [4]

(i) Draw the regression line on your diagram. [1]

(ii) Use the regression line to estimate the time taken by a participant who travelled 350 km. [2]

(c) Find the product moment correlation coefficient between t and d. Comment on the results. [4]

Jun 2008

8. Two judges, A and B independently awarded marks, x and y respectively to the architectural designers. The table below summarises the marks awarded

Design	**Judge A**(x)	**Judge B**(y)
1	55	56
2	40	37
3	60	54
4	65	49
5	90	77
6	30	33
7	70	55
8	95	75
9	50	43
10	45	47

$$\sum x = 600 \quad \sum x^2 = 39\,900 \quad \sum y = 526 \quad \sum y^2 = 29\,548 \quad \sum xy = 34\,145$$

(a) Calculate the product-moment correlation coefficient between the marks awarded by the two judges and comment. [4]

(b) Find the equation of the regression line of y on x. [4]

Nov 2009

9. The table below shows examination marks in two papers for seven A-level Chemistry students.

Student	A	B	C	D	E	F	G
Chemistry Theory (x)	68	74	37	75	52	75	44
Chemistry Practical (y)	80	63	49	62	65	80	56

$$\sum x = 425 \quad \sum x^2 = 27\,359 \quad \sum y = 455 \quad \sum y^2 = 30\,375 \quad \sum xy = 28\,409$$

a) Find the equation of regression line y on x. [4]

b) Use your equation to estimate the Chemistry Practical mark for a student who gets 58 in the theory paper. [1]

c) Find the product moment correlation coefficient and comment on your result. [3]

Nov 2010

10. At Kurerana High School, 8 students studying chemistry prepared for a test and the time T, hours each student spent studying was recorded. The test was marked out of 50 and the results of the scored mark, M, for each student were as follows.

Study time (T)	4	3	4	5	4	7	7	8
Scored mark (M)	37	32	35	40	40	44	42	48

a) Plot a scatter diagram showing study time T, against the mark, M. [3]

b) Calculate the equation of regression line M = a + bT where a and b are constants to be determined. [5]

c) Draw the regression line on the graph and use it to estimate the study in hours and minutes for a student who scored 41 marks. [4]

d) Find the product moment correlation coefficient and comment on the relationship between study times and test marks. [4]

Nov 2011

11. The values of y, length of a spring in cm, were measured for preselected values of x, the load in Newtons, and are shown in the table:

x newtons	1	2	3	4	5	6	7	8	9	10
y cm	10.7	11.3	12.0	12.4	13.0	13.7	14.5	15.1	15.6	16.0

a) Draw a scatter diagram to represent the data in the table. [3]
b) Calculate equation of regression line Y on X. [4]
c) Fit the line on the scatter diagram and use it to predict the length for a load of 6,4 Newtons. [4]
d) Calculate the product-moment correlation and comment on the relationship between X and Y. [4]

Nov 2013

12. The manager of a women clothing shop did a small survey on the amount a woman spends on clothes. The findings were tabulated as follows:

Woman's age (in years) X	18	21	36	45	23	53	25	37	30	32
Annual expenditure on clothes (in dollars) Y	330	300	180	120	310	150	250	150	245	190

(a) Show the above information on a scatter diagram. [3]
(b) i) Calculate the equation of the regression line Y on X and fit it on the scatter diagram. [5]
ii) Use the regression line to Y on X to estimate the amount likely to be spend on clothing by a 40 year old woman. [2]
(c) i) Calculate the product-moment correlation coefficient.
ii) Comment on your answer in c) i). [4]

Nov 2014

13. A random variable X is normally distributed with mean 15 and standard deviation 6. If a random sample of 40 is chosen and found to have a mean $\bar{X}$, find
(i) $P(\bar{X} > 16)$ [4]
(ii) the sample size n such that $P(\bar{X} > 15.5) = 0.05$. [5]

Jun 2014

14. The amount of fuel used to cover 100km on 10 occasions travelling at different speeds using the same car was recorded as follows:

Speed(km/hr)	**Amount of fuel used (*l*)**
X	Y
80	8
100	10
130	15
110	12
90	9
60	8

70	8
80	9
140	17
95	10

(a) Find the equation of the regression line of the amount of fuel used (Y) on the speed (X) [4]

(b) Use your equation, in a) , to estimate where possible, the amount of fuel likely to be used when travelling at

(i) 105 km/hr

(ii) 50 km/hr [4]

(c) Find the product moment correlation coefficient and comment on the relationship between the speed and the amount of fuel used. [4]

Jun 2015

15. A taxi operator keeps records of the performance of is cars. The total distance travelled by a car since it was purchased as new is denoted by *m* and the distance it can travel with 1 litre of petrol is denoted by *d*. For 7 cars of the same make and model, the values of *d* against *m* for each car are shown in the table below.

***m*(x 1 00km)**	50	100	150	200	300	400	500
***d*(km)**	23	22	20	20	17	16	12

(a) (i) Draw a scatter plot for the data in the table.

ii) Comment on the relationship between the total distance travelled and the distance travelled and the distance travelled with one litre of petrol. [5]

(b) Find the equation of the regression line of *d* on *m* for the data. [4]

(c) Fit the regression line on the scatter diagram and use it to estimate the distance travelled per litre by a car which has travelled a total distance of 450 000 km. [5]

Jun 2016

16. The heights of 10 boys and their corresponding weights were measured and recorded in the table below,

Weight,w (kg)	38	39	43	44	35	32	31	42	49	41
Height, h(cm)	150	152	146	158	142	144	135	145	155	150

(a) Plot a scatter diagram showing the weight w, against the height, h. [3]

(b) Calculate the equation of the regression line *h*=*c*+*dw* where *c* and *w* are constants toobe determined. [4]

(c) Use the equation of the regression line to estimate the height , in cm, of a boy whose weight is 40kg. [2]

(d) (i) Find the product moment correlation coefficient. [2]

(ii) Comment the relationship between the weights and the heights of the boys. [2]

Nov 2017

17.Marks X, and Y obtained by each of ten candidates in Mathematics are given in the table below. X is the mark for paper 1 and Y is the mark for paper 2.

X	86	93	73	66	88	96	80	70	95	63
Y	71	76	61	52	75	94	71	60	85	55

(a) Show the information on a scatter diagram. [3]

(b) Find the equation of the regression line Y on X in the form $y=mx+c$. [3]

(c) Fit the regression line on the graph. [2]

(d) Use the graph to estimate the paper 2 mark for a candidate who has a paper 1 mark of 75. [2]

(e) (i) Calculate the product moment correlation coefficient. [3]

(ii) Comment on the value in i) [1]

Jun 2017

SAMPLING AND ESTIMATION

ZIMSEC PAST EXAM QUESTIONS

1. A random sample of 12 values is taken from a normal distribution whose mean, µ, and variance, σ2, are unknown such that
   $\Sigma x = 5472$
   $\Sigma(x - 456)^2 - 1\,236.$
   (i) Explain what is meant by an unbiased estimate of a population parameter.[1]
   (ii) Calculate unbiased estimates of µ and σ^2 [3]
   (iii) Hence find a 97% confidence interval for σ [4]

Nov 2003

2. Gamma Engineering company manufactures bolts which are sent to customers in batches of 5 000. The company operates a sampling scheme whereby a random sample of size 8 is taken from each batch ready for dispatch. A batch is accepted only if the number of defective bolts in the sample is less than 2, otherwise the batch is rejected and re-processed.
   (a) If 5% of all the bolts produced are known to be defective, find the proportion of batches that will be rejected. [4]

(b) The company replaces all its bolt producing machines causing the proportion of defective bolts to drop to 0.5%. It now accepts batches only if there are no defective bolts in a sample of 8. Calculate the change in proportion after the replacement of the machines. [5]

Nov 2003

3. In 1995, a newspaper reported that for families residing in its circulating area, the distribution of the daily expenditure for food consumed away from home had an average of \$814.11 and a standard deviation of \$20.58. in order to check this claim an Economist randomly sampled 100 families residing in the area.
   Assuming that the newspaper claim was true
   (i) Describe the sampling distribution of the mean daily expenditure. [2]
   (ii) Calculate the probability that the sample mean daily expenditure for food purchased away from home was at most \$820.00. [3]

Jun 2004

4. (a) Much emphasis has recently been placed on preventive behaviour because of the AIDS pandemic. In one study at an AIDS awareness campaign conference, 100 questionnaires were issued out randomly. Assuming that the population mean and standard deviation of the questionnaire scores are 38 and 5 respectively.
   (i) state the sampling distribution of the sample mean questionnaire score, [1]
   (ii) calculate the probability that the sample mean score exceeds 39.1. [4]
   Given that the questionnaire mean score was 39.1, state and explain the nature of the sample. [2]

(b) A population of locusts has mean mass μg and standard deviation 6g. A random sample of size 100 is taken. State the distribution of the sample mean mass. [2]
   Given that the actual masses in the sample are summarized by
   $\Sigma(x - 50) = 270$ and $\Sigma(x - 50)2 = 2540$, where x g is the mass of a locust, find
   (i) unbiased estimates of μ and δ, [3]
   (ii) a 95% confidence interval for the population mean mass. [3]
   Twenty different random samples are taken and a 95% confidence interval for μ is calculated for each sample.
   State the expectation of the number of these confidence intervals that will contain μ. [1]

Nov 2004

5. (a) A large number of samples of size n are taken from $N(100,225)$,. Given that 95% of the sample means are less than 105, estimate the value of n. [5]
   (b) The random variables X and Y are independent and normally distributed, X being $N(4,9)$ and Y being $N(5,16)$. Given that a sample of 20 observations is taken from the distribution of X and a sample of 25 from the distribution of Y, find $P(\bar{Y} > \bar{X})$. [5]

Nov 2008

6. The diameters of 25 steel rods are found to have a mean of 0,980 cm and a standard deviation of 0,015 cm. Assuming that the diameters of the steel rods are normally distributed with the same variance, find 99% confidence limits for the population mean. [4]

Jun 2008

7. A random sample of size 40 is selected from a particular population of fish in a fishery pond. The random variable X denotes the length of fish in centimetres. Given that the actual length in the sample are summarised by $\sum(x-20)=19$ $\sum(x-20)^2=69$, find the unbiased estimates of
   (a) (i) the population mean. [1]
   (ii) the population variance. [2]
   (b) The 95% confidence interval for the mean life of light bulbs constructed from a sample of size 36 is (1023,3hrs; 1161,7hrs) Assuming that the life of light bulbs is normally distributed find the 99% confidence interval for the mean life of this brand of bulbs. [6]

Nov 2009

8. The following data have been collected for a sample from a population that is normally distributed.
   5, 10, 8, 11, 12, 6, 15, 13
   (a) Calculate the unbiased estimate of the population mean, and the standard deviation. [3]
   (b) Find a 95% confidence interval for the population mean. [5]

Nov 2010

9. The ice-cream vendor records his daily takings (\$x) over a period of 30 days. The results were summarised by $\sum x = 900$ and $\sum x^2 = 34\,000$.
   (a) Find the unbiased estimates of
   (i) the population mean,
   (ii) the population variance. [3]
   (b) Calculate at 95 % confidence interval the mean amount he receives assuming that his daily takings are normally distributed. [3]

Nov 2013

10. A random variable X is normally distributed with mean 15 and standard deviation 6. If a random sample of 40 is chosen and found to have a mean $\bar{X}$, find
   (i) P($\bar{X}$ > 16) [4]
   (ii) the sample size n such that P ($\bar{X}$ > 15.5)=0.05. [5]

Jun 2014

11. The masses of letters posted by a certain school are normally distributed with mean 15 g. It is found that the masses of 95% of the letters are within 10 g of the mean. Find,

(a) the standard deviation of the masses of the letters. [3]
(b) the probability that at least 2 out of a random sample of 8 letters have masses within 10 g of the mean. [3]

Jun 2015

12. (a) Define the term random sample and state any two methods of obtaining such a sample. [3]
(b) A school head was asked to send 10 students for an exchange program with a sister school in another country. The head of the school was asked to supply the names of the 10 students within 3 days. The head then went to choose 10 students from those who already had valid passports.
(i) Name the method of sampling used by the head of the school.
(ii) State, giving reasons whether the method used would give rise to a random sample. [3]

Jun 2015

13 (a) Distinguish between 1 tailed and 2 tailed test. [2]
(b) It is claimed that rural secondary school pupils travel a distance of more than 12km to school. To test this claim, a random sample of 100 pupils were asked to keep a record of the distances they travel to school. The random sample showed an average distance of 14,5 km with a standard deviation of 4.8km. Test at 0.05 level of significance whether the claim is true. [6]

Jun 2015

14 (a) A dozen loaves of bread were taken at random from a large batch and weighed. The masses were found to be 741; 701; 834; 829; 808; 660; 659; 739; 472; 865 and 801 grams. Assuming that the masses of the loaves are from a normal distribution, find the unbiased estimate of the population
(i) Mean
(ii) variance. [3]
(b) Another batch of 50 loaves gave a mean of 750 grams. Given that the population variance of the loaves is 10 816, construct a 90% confidence interval for the mean mass of the loaves. [4]

Jun 2016

15. A factory has several machines producing wheel bearings which over a period of time, have been found to have a mean mass of 50.6g and a standard deviation of 3.6g. One machine is tested by taking a sample of 36 bearings which are found to have mean mass of 48.8g.
(i) Determine the 95% confidence interval within which the population mean must lie. [3]
(ii) Comment on the condition of the machine. [1]

Nov 2017

16. A random sample of size 36 is taken with replacement from a normal population : 1;1;1;3;4;6;6;6;7 Find the probability that a sample taken at random will have a mean greater than 3.8 but less than 4.5. [5]

Nov 2017

17. The random variables, R and S, are normally distributed . Given that R~N(54,36) and S~N(48,25)
    (a) Find
        (i) the value of r and s such that $P(R \leq r) = P(S \geq s) = 0.48$ [7]
        (ii) $P(R \geq S)$ [2]
    (b) Six independent observations of R are taken. Find the probability that the sum of six observations is less than 300. [5]

Jun 2017

SIGNIFICANCE TESTING

ZIMSEC PAST EXAM PAPERS

1. (a) The distribution of a population is known to have mean 9.27 and standard deviation 1.40. A sample of 36 was taken from this population and it gave a mean of 8.39. Test whether there is evidence at the 1 % level that the mean has decreased. [6]
   (b)An animal breeder claims that the length of a certain species of animals is distributed normally with mean 44cm. In order to test the truth of this claim, a sample of 21 such animals was taken and it was found that $\bar{x}$ = 42 cm and $s = 6\ cm$. Is there evidence at 5% level to refuse the breeder's claim? [6]

Nov 2008

2. The diameters of 25 steel rods are found to have a mean of 0,980 cm and a standard deviation of 0,015 cm. Assuming that the diameters of the steel rods are normally

distributed with the same variance, find 99% confidence limits for the population mean. [4]

Jun 2008

3. A manufacture of an item used for the production of metal rods claims that new machine that he has acquired has resulted in an improved product. The old machine is known to have given 20% defectives per output. Test at 5% significance level the validity of the claim if out of a sample of 20 items 2 were found to be defective. Use the binomial test. [7]

Nov 2009

4. Prior to the institution of a new safety program, that average number of on-the-job accidents per day at a factory was 4.5. To determine if the safety program has been effective in reducing the average number of accidents per day, a random sample of 30 days is taken after the new safety program. The number of accidents per day is recorded. The sample mean and standard deviation were computed as follows.
   $x = 3.7$ and $s = 1.85$
   Is there sufficient evidence to conclude at 1% significance level that the average number of on-the-job- accidents per day at factory has decreased since instituting the safety program? [7]

Jun 2004

5. The Zimbabwe consumer report (1999) states that the mean retail cost of Nokia 5110 cellular phone was $600.00. A random sample of 10 stores in Harare, gave the following prices for this model,
   593 621 545 561 609 555 588 575 619 599
   (a) Calculate the mean and standard deviation of the above data. [3]
   (b) Assuming that the retail costs of these cellular phones are normally distributed, test at 10% level of significance whether this information indicates that the population mean of the cost of the cellular phones is less than $600, 00. [6]

Nov 2007

3. (a) In an election held in 2007, 60% of the voters voted for Party A. In a poll of opinion conducted last week, 250 potential voters were asked how they would vote if there was an election now. 135 of the voters said they would vote for Party A. Investigate at 5% level of significance whether the proportion of the voters in favour of A has decreased significantly. [6]
   (b) Ambulance Services claims that it takes an average of 8,9 minutes to respond to emergency calls. To verify this claim, the Agency which licences ambulance services timed 50 responses to emergency calls. The observed data gave a mean of 9,3 minutes and standard deviation of 1,8 minutes. Test at 5% significance level whether there is evidence to justify Ambulance service's claim. [8]

Nov 2010

4. A milling company found that the bag of flour it packs weighs 10kg each on average. A random sample of 50 bags is examined and the mass, x kg, of the contents of each bag is recorded. It is found that $\sum(x-10) = -12.3$ and $\sum(x-10)^2 = 37.7$
   (a) Estimate the population mean and variance of the mass of the contents of a bag. [4]
   (b) Test at 10 % level of significance, whether the milling company is overstating the average mass of the contents of each bag. [6]

Nov 2013

5. A sample of 10 items are taken from a production line to check if the machine is functioning properly. The components produced by the machine are set to have a mean diameter of 2 cm and a standard deviation of 0.03 cm. The ten items had their diameters measured and the results were:
   2.17 1.93 2.02 1.97 2.00 1.02 2.02 1.89 1.99 2.01
   Test at 5 % level of significance whether the components produced by the machine are of the required standard. [9]

Jun 2013

6. (a) Distinguish between a 1-tailed and a 2-tailed test. [2]
   (b) A political party claims that it commands 60 % of the voters. To test this, a random sample of 300 potential voters was asked which party they would vote for. 160 confirmed that they would vote for that party. Establish whether this sample supports the claim by the party. Test at 10 % level of significance. [7]

Jun 2014

7. The following are television prices in dollars taken in 40 different shops

40	130	170	240	360	520	170	130
240	360	520	120	220	170	330	480
160	290	200	120	480	160	210	330
70	140	180	260	370	90	150	200
280	450	80	420	190	140	270	120

   (i) Construct a stem and leaf diagram for the data. [3]
   (ii) Find 1. the median,
   2. the quartiles. [2]
   (iii) Draw a box and whisker plot. [2]

Jun 2014

8. (a) Distinguish between 1 tailed and 2 tailed test. [2]
   (b) It is claimed that rural secondary school pupils travel a distance of more than 12km to school. To test this claim, a random sample of 100 pupils were asked to keep a record of the distances they travel to school. The random sample showed an average distance of 14,5 km with a standard deviation of 4.8km. Test at 0.05 level of significance whether the claim is true. [6]

Jun 2015

9. A manufacturer of orange juice claims that the volumes of packets which the firm produces are normally distributed with mean 1 000ml and variance 16. A consumer right inspector tests a sample of 20 packets and finds that the average volume is 997.5 ml. Test at 1% significance level to establish whether or not the manufacturer is overstating the volume of the contents. [5]

Nov 2017