QUESTION ONE (30 marks)

a) Briefly describe the structure of a bioassay. [3 marks]

b) In the context of epidemiologic differentiate between

     i)   Experimental and observational studies. [2 marks]

     ii)   Case-control studies and cohort studies. [2 marks]

c) Briefly explain main types of disease outbreaks. [6 marks]

d) A simple random sample (SRS) of body weight expressed as a percentage of ideal in 9 high school girls reveals:

     114, 100, 104, 94, 114, 105, 103, 105, 96

    (i)   Calculate a 95% confidence for population mean μ of this variable in the school. [2 marks]

    (ii)   How large a sample would be needed to reduce the margin of error of the 95% confidence interval down to 3? [2 marks]

e) In a randomized clinical trial of women with pregnancy-induced hypertension 23 women received aspirin and 24 received a placebo. After two weeks on treatment the mean diastolic arterial blood pressure of the aspirin-treated group was 111 mm Hg (s_1 = 8 mm Hg) and the mean blood pressure of the control group was 109 mm Hg (s_2 = 8 mm Hg). Determine whether this difference is significant. Show all hypothesis testing steps. [6 marks]

f) The following data consist of a random sample of 793 individuals who were involved in motorbike accidents during last year in Kisumu central business district.

Head Injury	Wearing Helmet		
	Yes	No	Total
Yes	17	218	235
No	130	428	558
Total	147	646	793

i) Construct a 90% confidence interval for odds ratio, and interpret.

[3 marks]

ii) Conduct a test of statistical independence between head injury and wearing helmet. Interpret. [4 marks]

QUESTION TWO (20 marks)

The following table shows a display of myocardial infarction (heart attacks) and treatment reported, where physicians did not know which type of pill they were taking every other day for a five-year randomized study.

Group	Myocardial Infarction (MI)		
	Yes	No	Total
Placebo	189	10845	11034
Aspirin	104	10933	11037

a) Calculate and interpret the sample relative risk of MI. [2 marks]

b) Construct a 95% confidence interval for the relative risk. Interpret the results. [3 marks]

c) Calculate and interpret the sample odds ratio of MI. [2 marks]

d) Construct a 95% confidence interval for the odds ratio, and interpret. [7 marks]

e) Explain why the odds ratio approximately equals the relative risk. [1 mark]

f) Use Pearson chi square to test at 5% significant level whether there is a relationship between aspirin use and myocardial infarction. [5 marks]

QUESTION THREE (20 marks)

a) Describe the TWO types of indirect assays. [2 marks]

b) The following data represent the effect of a series of doses of carotene (an insecticide) when sprayed on Macrosiphoniella sanborni (some obsecure insects). It contains the concentration, the number of insects tested at each dose and the number of deaths.

Concentration (mg/l)	Number of insects	Number of affected
10.5	50	44
7.8	49	42
5.2	46	24
3.9	48	16
2.4	50	6
0	49	0

i) Using the Probit model, determine ED50 and interpret your result.

[14 marks]

ii) Name the type of assay used in this study. [2 marks]

iii) What was the significance of dose zero? [2 marks]

QUESTION FOUR (20 marks)

a) Distinguish between

i) Analytical and comparable dilution assays. [4 marks]

ii) Parallel line and slope ratio assays. [2 marks]

b) The "cat" method for the assay of digitalis was applied to two groups of cats. Strophanthus A and Strophanthus B were given to the two groups separately until a cat in each group dies. The dose was immediately measured on death and the response recorded as follows:

Preparation	Tolerance
Strophanthus A (Test prep in .01cc/kg)	1.57, 1.52, 1.70, 1.43, 1.96, 2.24, 1.39, 2.1
Strophanthus B (Standard prep in .01cc/kg)	2.40, 1.66, 1.62, 1.80, 2.23, 2.19, 2.41, 2.43, 1.49

i) Determine the relative potency and interpret your result.

[4 marks]

ii) Construct a 95% confidence interval for the true relative potency.

[10 marks]

QUESTION FIVE (20 marks)

a) Consider the following results from a screening test for HIV that was performed on a group of 100,000 people:

		Test Result		
		Positive	Negative	Total
HIV	Positive	475	25	**500**
Status	Negative	4975	94525	**99500**
	Total	**5450**	**94550**	

Determine the

i) Prevalence rate of HIV in this group. [2 marks]

ii) Sensitivity of this test. [2 marks]

iii) Specificity of this test. [2 marks]

iv) False positive rate. [2 marks]

v) False negative rate. [2 marks]

vi) Comment whether the researchers were justified to apply this screening test to the population. [2 marks]

b) An efficacy study was conducted for the drug pamidronate in patients with stage III multiple myeloma and at least one lytic lesion. In this randomized clinical trial, patients were assigned at random to receive either pamidronate or placebo. One endpoint reported was the occurrence of any skeletal events after 9 cycles of treatment or non-occurrence.