Name: _____

1. For each of the two scenarios identify whether the rows of the example data are a statistically independent sample, or if the rows are dependent on each other. Please provide a one or two sentence explanation.

   (a) A commercial vehicle servicing company runs a large maintenance shop with a complex multistage workflow. A mechanic can only service one vehicle at a time. The vehicles are not moved, so only one service bay can hold a vehicle at a time. The quality control on the maintenance requires that only one mechanic can service a vehicle at a time. You have been given a dataset to determine bottlenecks in service process.

Vehicle	Bay	Mechanic	Start	Stop	$\cdots$
10	3	A	8	12	$\cdots$
10	3	B	13	17	$\cdots$
20	7	C	9	11	$\cdots$
20	7	A	13	15	$\cdots$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\ddots$

   (b) A biologist is testing a new growth enzyme for fruit bearing plants. The biologist has carefully designed a controlled experiment of the effect of the soil concentration of the enzyme, ensuring all other conditions are held constant across all the plants, and each plant was isolated. At the end of the study the total mass of fruit produced was measured.

Plant	Soil Concentration	Fruit Mass	$\cdots$
1	0.5	4	$\cdots$
2	1	10	$\cdots$
3	2	12	$\cdots$
$\vdots$	$\vdots$	$\vdots$	$\ddots$

2. The analysts at a shipping company estimate mileage costs in dollars ($) with a simple linear equation $f(X) = Y + r \cdot X$, where X is the mileage measured in total kilometers traveled by the shipping vehicles, and Y is the constant cost of operation.

   Using reports from their tracking database the constant cost Y was stated as $7639.37. However, the constant cost reimbursement system only pays out in multiples of $100 dollars. The total mileage X was reported as 479456 km, but the odometer tracking only has a resolution of 10 km.

   (a) Using rounding at half away from zero please round each measurement to the reliable digits, and using the standard notation from class provide the absolute uncertainty of the constant cost and the total mileage.

   (b) Assuming the company has set the value of the rate constant r as 125, what are the units of measurement of r, and what is the absolute uncertainty in the total mileage cost $f(X)$.

3. A service company is planning to implement random drug screening of their site workers. Currently only 3 in 100 Albertans use illicit stimulants. Please use the outlined drug screening Confusion Matrix in your answer.

	Actual Substance Use	
Test Result	Absent	Present
Positive	3/20 False Positive	19/20 True Positive
Negative	17/20 True Negative	1/20 False Negative

(a) If a worker tests positive what is the incorrect conclusion reached by the Prosecutor's Fallacy, please specify either of the incorrect probabilities from the confusion matrix.

(b) What is the correct conclusion and probability of having used illicit stimulants, please show your work.