Week 8 Questions

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Q1

1. Firstly, the students may not be honest while filling the poll which leads to the data collected being invalid and any result from it will not be reliable.

It is also possible that not all students would reply to the poll, thus the data set collected would be quite small and the result would be a very inaccurate estimation of the fraction of students trying to pass

1. Repeating the experiment many times is not a suitable solution as we are still susceptible to the problems mentioned above.

One way for this experiment to be successful would be to take the poll multiple times over the academic year. We would still face similar problems as in the previous methods however we would be able to analyse this data for any inaccuracies in the responses from the students.

Another way is to make the response to the poll compulsory for all students.

Q2

1. Two variables, X and Y, are identically distributed if they have the same probability distribution. A condition for this is CDF(X) = CDF(Y)

Even more formally and in the general case of k random variables (X1, X2... Xn) it can be said that they are Identically Distributed if their marginal distributions have the same form: f(Xk;θk) ≡ f(Xk;θ), for all k=1,2...,n.

1. Y is not a random variable.
2. Answer in pic below
3. Text, letter

   Description automatically generated

Cherbyshev’s theorem requires only a finite second moment however sharpening the bound requires stronger assumptions about the random variables in question.

In CLT, we get a full distribution of X. however it only works for a finite Ns and requires a mean and variance.

1. Code listing from matlab :

size = 1000;

n = 100;

mean = zeros(1,size);

for x = 1:size

sample = binornd(n,0.1);

mean(x) = mean(sample)/n;

end

histogram(mean);

sample\_mean = mean(mean);

sample\_SD = std(mean);

sample\_standard\_error\_of\_mean = sample\_SD/sqrt(size);

confidence\_interval\_of\_mean = sample\_mean + 1.96\*sample\_standard\_error\_of\_mean\*[1;-1];

disp(confidence\_interval\_of\_mean);

disp(sample\_mean);