Cairo University

Faculty of Engineering

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Probability & Statistics
Statistical Measures Using Python

Under the supervision of Prof. Maha Hassanein

Presented by:

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Table of Contents

List of figures

1. Abstract

The application is designed using python Tkinter, Numpy, MatPlotLib, Pandas libraries.
Design of Application:.The application main page has 3 buttons labeled, Hypothesis, Descriptive, and Sampling from top to bottom representing the 3 sections of our application.
Each Button opens a new page for the user:

For Hypothesis: A page with one input text field for the user to enter their expected salary and user should press a button labeled Store Salary to store salary they entered. Below it a drop-down menu to state whether he wants a confidence level of 95% or 99%. Then, a button labeled, Get Results should be pressed to view the hypothesis result in an output field below.

For Descriptive: A page with a drop-down menu that has a list of graphs from which the user can choose how they want the data to be plotted. Available graphs are: Bar Chart, Histogram, Box Plot, and Dot-Diagram.

Below it another drop down menu for spread measures, Available measures are: Mean, Mode, Median, and Standard deviation. The result of this measure is displayed in an output field below.

For Sampling: A page with two input fields is opened, first input field is for entering length of samples wanted to be extracted from given data, and second input field is for entering the number of samples wanted to be tested. The means of these samples are then plotted, the user can choose one of two graphs: Histogram or a Box Plot
All 3 pages have a Back button to return to the main page.

2.Problem definition

For example you can use application to know the range of salary in England for last 10 years

Regardless of where you are in your job search, it can be useful to know salary information for a particular field. Average salaries can be calculated and listed using different formulas, most frequently median and mean salary. Median and mean salaries can produce two very different numbers, so it's important to understand the way median salary is determined.

It also probably won't surprise you to learn that Londoners are taking home the most money – on average £640 per week. The median in the capital is £141 more per week than the next highest, the South East (£498), and £161 more than the median for the whole of the UK (£479). Take this figure with a pinch of salt, though, as it's boosted by the city's super-earners – think CEOs on six, or even seven, figures. In regional terms, on place-of-residence basis, the North East has the lowest median pay, at £523.50 a week for full-timers.

It also pays to have a bit of experience in the working world. Those aged 16 to 17 earned the least last year, an average of £206.60 per week (£201.10 for men and £240.20 for women). This is the only age at which women are more likely to earn more than men, with the figures quickly jumping to £354.80 for and £345 for men and women between the ages of 18 and 21, respectively. Unfortunately, you can expect your earnings to peak during middle age, with those aged 40 to 49 earning more than any other age group at a median of £676.30 a week. After that, the average salary decreases steadily as you approach retirement age: full-timers aged 50-59 earn an average of £624.40 per week. And for those aged 60 and above, the figure is £539.80. Keep in mind that these numbers probably also start to dip as a consequence of workers retiring, thus reducing the average income significantly.

There's a chance that you might not be earning as much as your peers because of the industry you're in. That's fine if you're head-over-heels passionate about your job and you're earning enough to support yourself, but if money's your main motivator you might want to consider a switch. Still, it's worth bearing in mind that the highest-paid jobs in the country belong to chief executives and senior officials, who earn an average of £1,538.70 per week. If you really want to earn the most money possible, it could be worth biding your time and working your way up in your current company – or getting into politics, but who wants to join Westminster right now?

It won't surprise you to learn that, initially at least, Covid-19 had a negative impact on average earnings in the UK. However, following a sudden drop at the onset of the pandemic, figures began to climb steadily. Between March 2020 and January 2021, average weekly earnings increased by 6.5 per cent, including bonuses, and 4.3 per cent for regular pay, according to the ONS. Partly, this is what we call the "composition effect" – which means that because many of the jobs that were lost during the pandemic were in low-paid sectors (hospitality, for example), the average for the jobs that remain has been brought up. That being said, there has been a noticeable increase in unemployment rates, which have grown from 4.1 per cent in the March to May 2020 period to five per cent in the November to January 2021 period.

Unhappy with where you currently stand against the rest of the population? Well then, the time to start working towards a raise is now. But we're not suggesting that you immediately storm into your

boss’s office and demand more money after reading this article. Getting what you think you deserve is a much more delicate process that must be done right in order to succeed.

It’s important to keep in mind that you should expect a raise about once a year, so if your earnings have already been given a boost quite recently, then it’s probably best to grit your teeth and make do with what you’ve got for now. On the other hand, if it’s coming up to a year or more since your salary last got a hike, you should start working on your strategy immediately.

The most obvious time to ask for a pay rise is during a performance review, so it’s a good idea to make sure you know when your next one is coming up. Unfortunately, a lot of how you approach the rest of the process depends on your manager’s personality. If they’re a no nonsense and straight to the point kind of character, then an email in the run up to your review clearly stating that you would like to discuss a revised salary should go down well. In other cases, you might have to slip it in during another conversation.

But whenever the topic does finally come up, make sure you’re prepared with a good case as to why you actually deserve a raise. Have you taken on any more responsibilities since your last pay rise? Or developed any new strategies that have significantly benefited the company? Have a long think and have these points clear in your mind before you go in and ask for more money. You need to deliver your case with confidence, so there’s no room for forgetting key points and stumbling over words – a morning rehearsal of your statement in front of your bathroom mirror probably wouldn’t hurt

So the challenging is to get accurate relation which will help us at forecasting which our salary will help to avoid wrong planning or causing financial burden as overestimation of load demand causes waste our effort and our application help you to know that or any thing

3.Methods of Solution

In this program we are calculating the mean, median

,mode, variance, Frequency distributions, variance in the descriptive part

This is done using the following equations

1. Mean $\bar{x} = \frac{\sum x}{n}$
2. Median $= X_{(n+1)/2}$
3. Mode
4. Standard Deviation= s = $\sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

We draw a lot of graphs to show the distribution of the data :

1. Bar Chart.
2. Histogram.
3. Box Plot.
4. Dot Diagram

In statistical inference part we calculate:

1. Sample mean.
2. Distribution of sample mean.
3. Hypothesis Testing

For Example
Population: $\mu = (\mu \text{ of the data})$, Sample: $n = 1500$

Step 1: H0: μ = 20000 (user input) and Ha: $\mu > 20000$

Step 2: choose level of confidence for example 95%
The maximum acceptable error α= 0.05

Step 3: Using the Z-Test One-Tailed Hypothesis Test
Critical Region: $z > z_\alpha$

Step 4: the test statistic
$z = \frac{x - \mu}{S/\sqrt{n}}$

Step 5:
z>z_α you can get this salary otherwise you can't get this salary

4.Data Description

For example our application for The data is represent salary of fresh graduate engineers in London

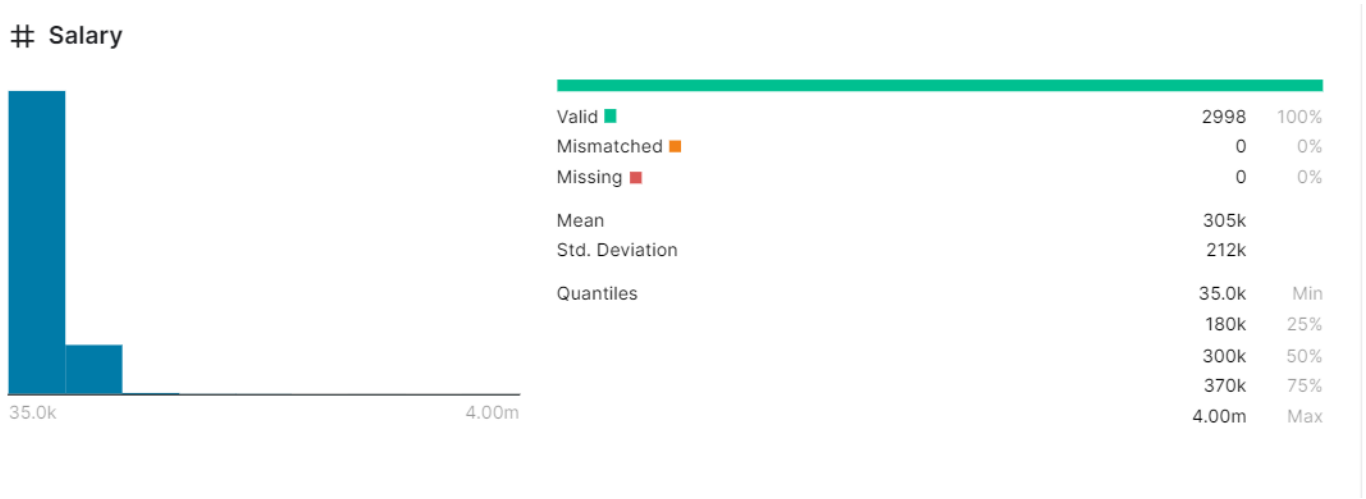

Figure 2 show median of salary in regions in England from website “kaggle”

5.Analysis of the results:

in the first of application what test you want to do

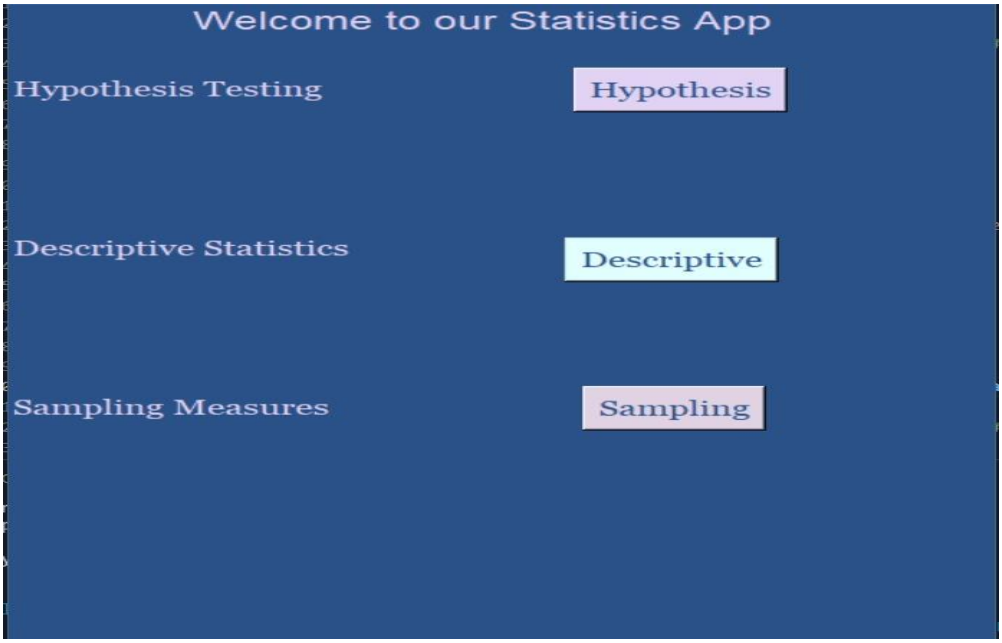

Figure 2 Start window

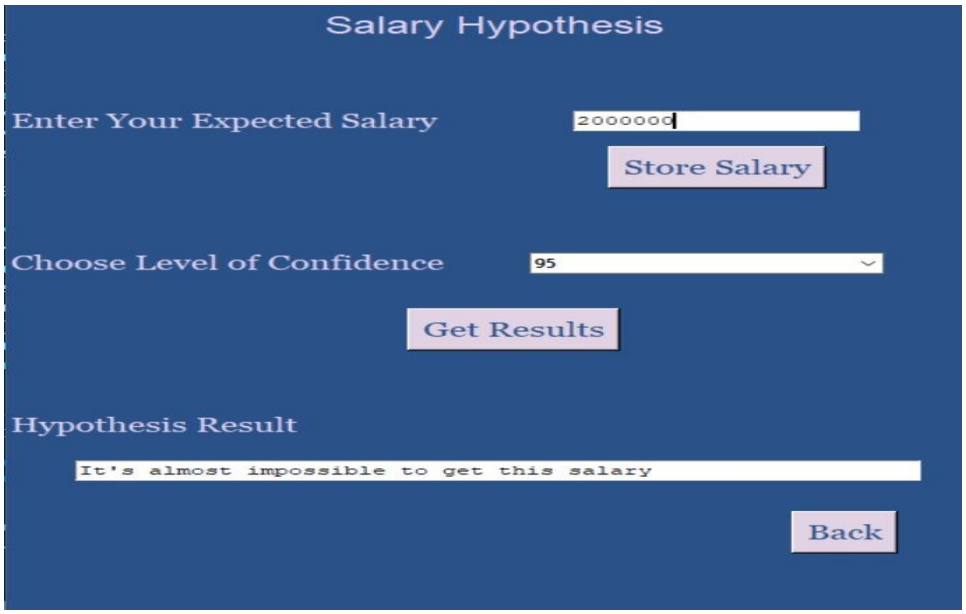

Figure 3 Hypothesis Testing window

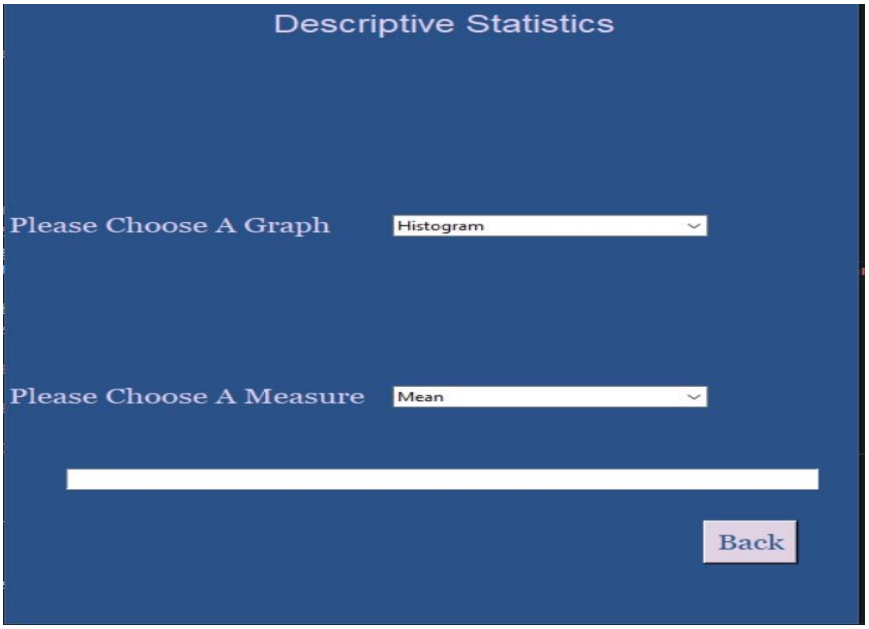

Figure 4 Descriptive Statistics window

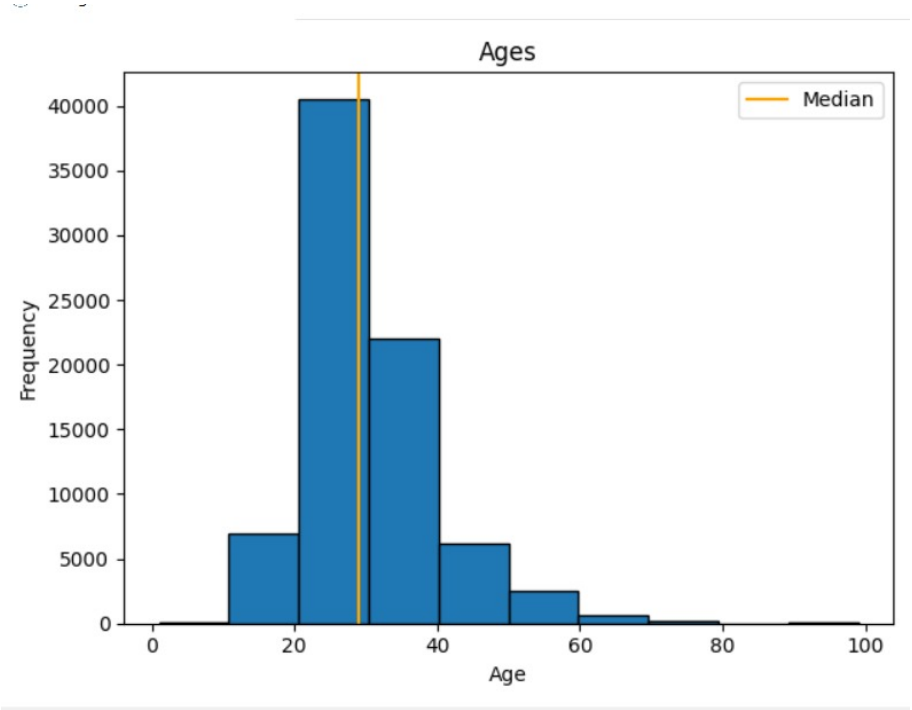

Figure 5 Histogram t for analyse data

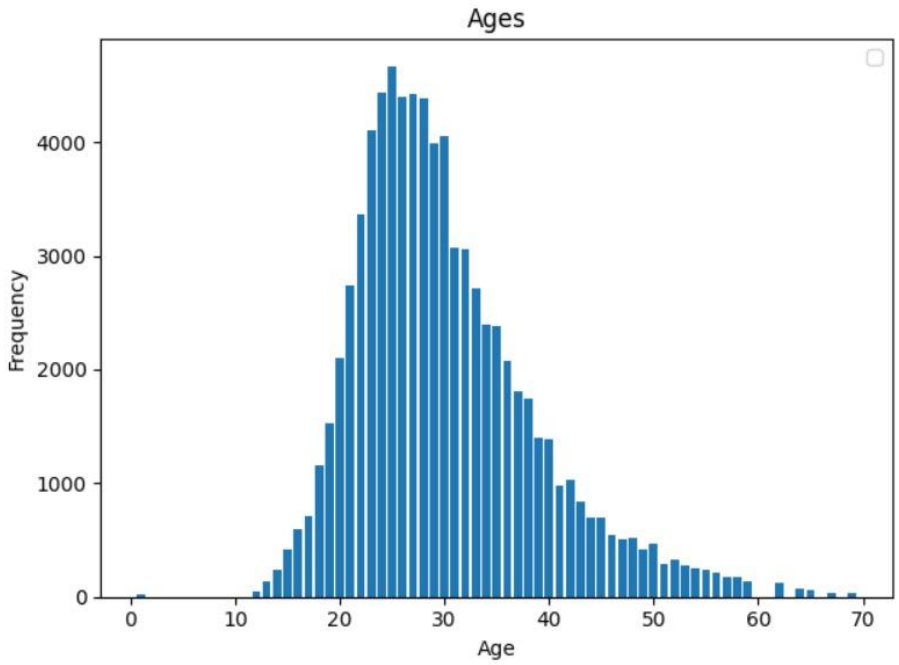

Figure 6 Bar chart for analyse data

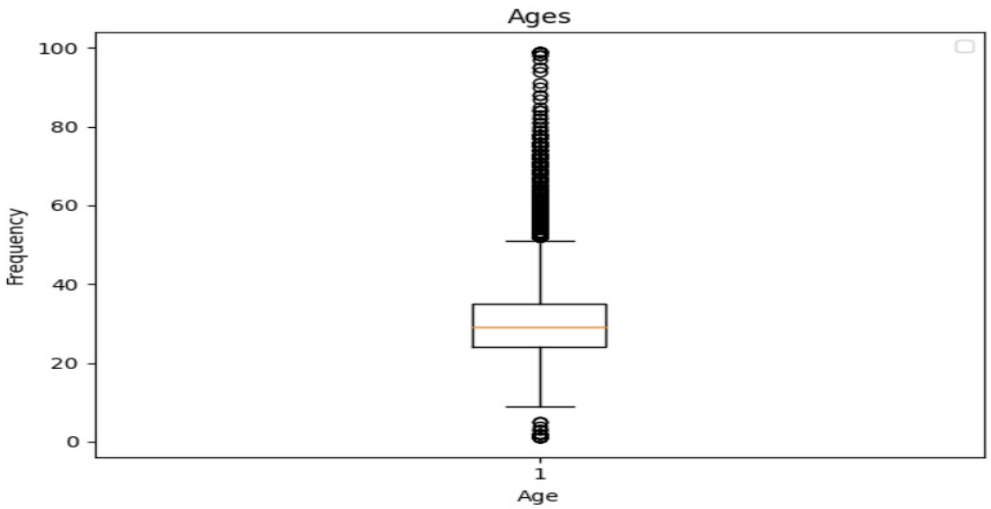

Figure 7 Box chart for analyse data

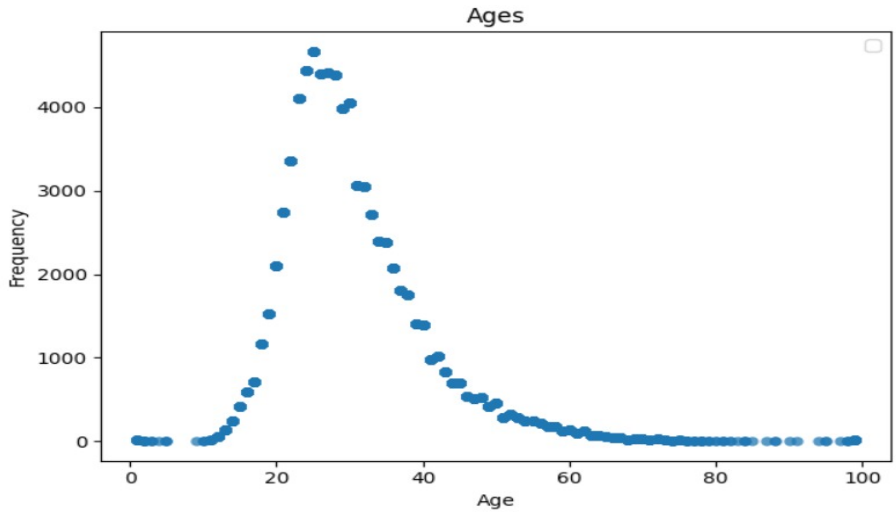

Figure 8 Dot Diagram for analyse data

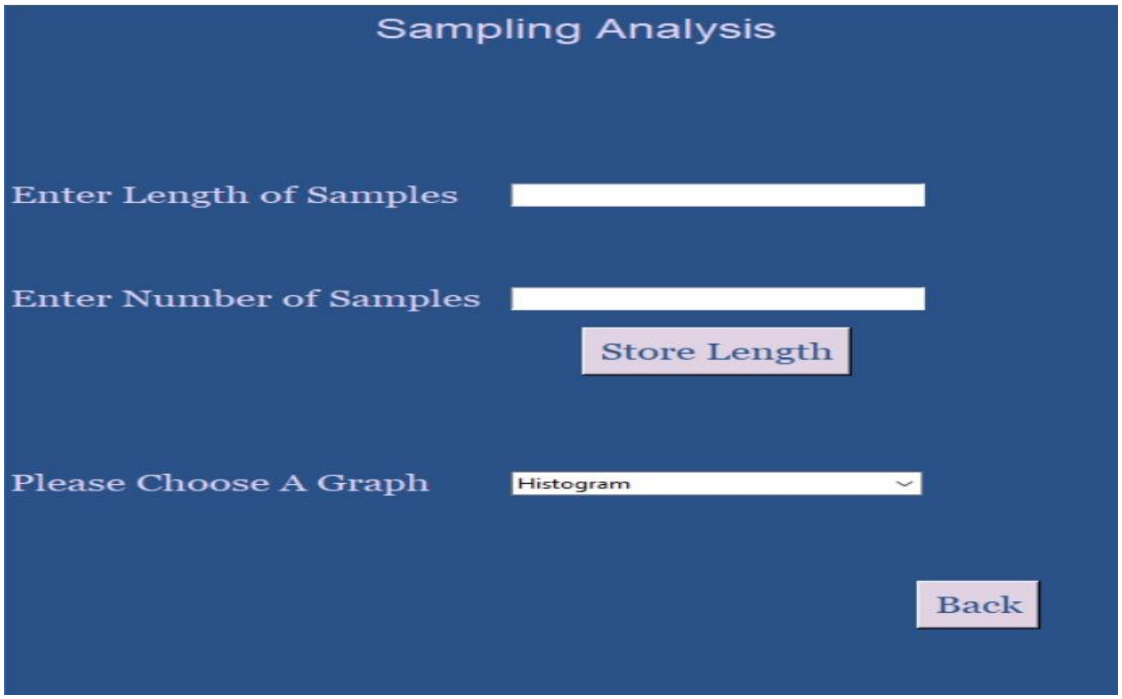

Figure 9 Sampling Measure view

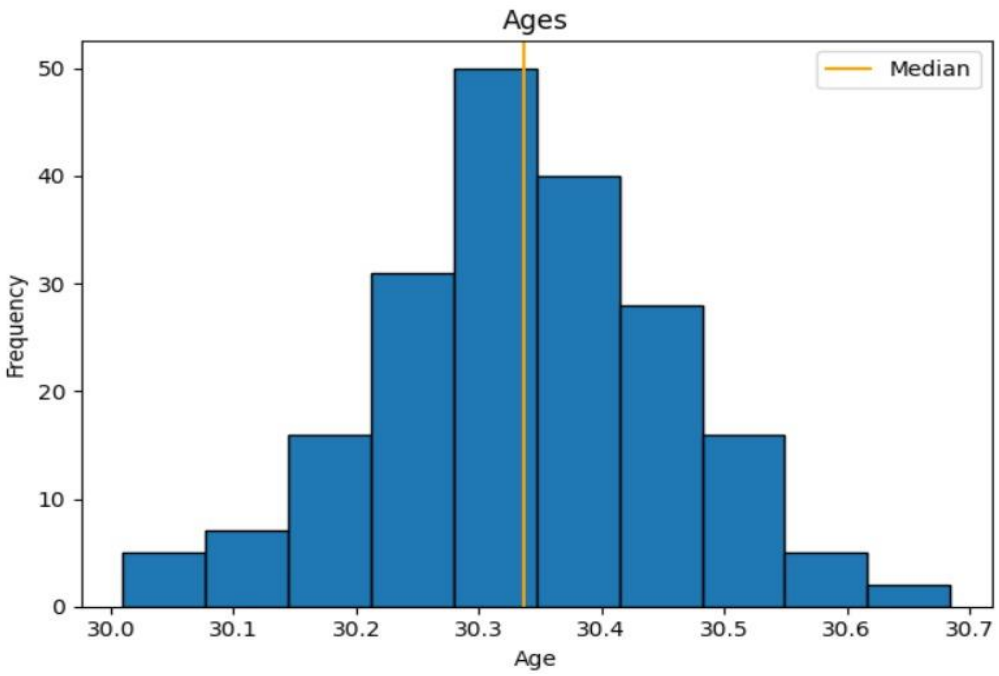

Figure 10 A plot of Sample Means of 200 samples of length 5000