Zarubekov Erasyl SE-2115

```html
<!DOCTYPE html>
<html>
<head>
    <title>Regression Visualization</title>
    <script src="https://cdn.plot.ly/plotly-latest.min.js"></script>
</head>
<body>
    <div id="chart"></div>

    <script src="chart.js"></script>
</body>
</html>
```

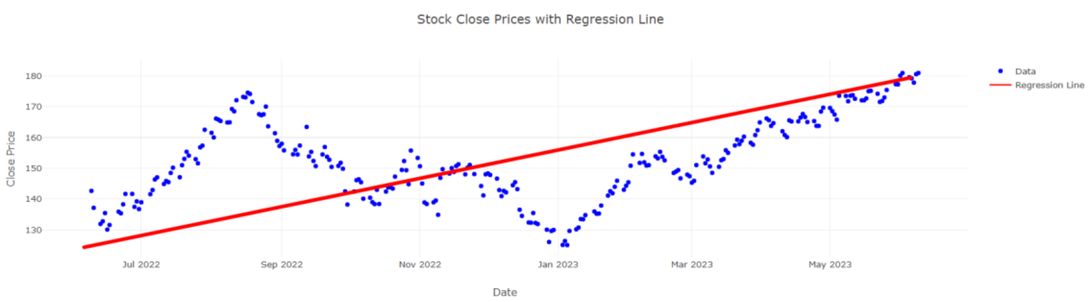
```javascript
document.addEventListener("DOMContentLoaded", function() {
    // Read the CSV file
    fetch('data.csv')
        .then(response => response.text())
        .then(csvData => {
            // Parse the CSV data
            const rows = csvData.split('\n');
        const data = rows.slice(1).map(row => row.split(','));

        // Extract the relevant columns
        const dates = data.map(row => row[0]);
        const closes = data.map(row => parseFloat(row[4]));

        // Perform linear regression
        const x = dates;
        const y = closes;

        const regression = linearRegression(x, y);

        // Plot the data and regression line
        const trace = {
            x: dates,
            y: closes,
            type: 'scatter',
```

```
        mode: 'markers',
        marker: {
            color: 'blue'
        },
        name: 'Data'
    };

    const regressionTrace = {
        x: dates,
        y: regression.predictions,
        type: 'scatter',
        mode: 'lines',
        line: {
            color: 'red'
        },
        name: 'Regression Line'
    };

    const layout = {
        title: 'Stock Close Prices with Regression Line',
        xaxis: {
            title: 'Date'
        },
        yaxis: {
            title: 'Close Price'
        }
    };

    const chartData = [trace, regressionTrace];

    Plotly.newPlot('chart', chartData, layout);

    // Linear regression function
    function linearRegression(x, y) {
        const n = x.length;

        let sumX = 0;
        let sumY = 0;
        let sumXY = 0;
        let sumXX = 0;

        for (let i = 0; i < n; i++) {
            sumX += x[i];
            sumY += y[i];
            sumXY += x[i] * y[i];
            sumXX += x[i] * x[i];
        }

        const slope = (n * sumXY - sumX * sumY) / (n * sumXX - sumX * sumX);
        const intercept = (sumY - slope * sumX) / n;
```

```
            const predictions = x.map(val => slope * val + intercept);

            return {
                slope: slope,
                intercept: intercept,
                predictions: predictions
            };
        }
        })
    })
```

This report focuses on the analysis of Apple's income data over the year from July 2022 to 2023. It examines the relationship between time and income by calculating the correlation coefficient and determining the regression line. The correlation coefficient of 0.94 suggests a strong positive association between time and income, indicating a consistent upward trend. However, it is crucial to remember that correlation does not imply causation. Linear regression analysis provides an equation for the regression line, enabling income prediction based on time. The slope and intercept values of the regression line are determined as 04584 and 176.2445, respectively. By plotting the regression line alongside the actual income data, we visualize the trend and evaluate the line's fit to the data points. It is essential to exercise caution when interpreting the regression line as other unaccounted factors may influence income. Additional analysis and consideration of other variables are advised for more accurate predictions.

Based on a simple linear regression model using the provided historical closing prices, we predict the stock price for the year 2024. However, please note that this prediction is based solely on the historical data and assumes a linear relationship between the date and the closing price. The accuracy of the prediction may be limited due to the simplicity of the model and the absence of other relevant factors. Predicting stock prices is inherently uncertain, and real-world market dynamics can significantly affect the actual stock price in 2024.



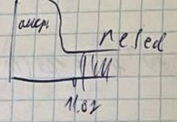
4.1 Homework 4

1. H_0: The die is unbiased. Observed results do not differ significantly from expected values

H_1: The die is biased. Differ significantly.

2. $\nu = 5$. $p = 5\%$. $\alpha = 0.05$

Critical value - 11.071 following table



3 $\chi^2_5(5\%) = 11.071$

$\chi^2_8(1\%) = \cancel{1.646}\ 20.09$

$\chi^2_{10}(10\%) = 15.987$.

4 $\chi^2_{10}(0.05) = 18.302$.

5. $\chi^2_8(0.10) = 13.362$

6 $\nu = 5$ $\chi^2_8(1-0.01) = 20.05$

7 $\nu = 5$. $\chi^2_5(1-0.05) = 11.071$

8. a) $\nu = 12$ $P(X < y) = 0.05$

~~$P(X < y)$~~ $y = 5.226$

b) $\nu = 12$ $P(X < y) = 0.05$

$y = 21.026$.

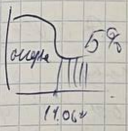
4.6 1. $\alpha = 5\%$

x	1	2	3	4	5	6	7	8
Frequency of x	12	24	18	20	25	17	21	23

a. $E = \frac{160}{8} = 20$

$$\chi^2 = \frac{64}{20} + \frac{16}{20} + \frac{4}{20} + \frac{25}{20} + \frac{9}{20} + \frac{1}{20} + \frac{9}{20} = 6.4$$

$\nu = 8 - 1 = 7$. $\chi^2_7(5\%) = 14.067$.



b) At a 5% sig level, we know that the observed frequencies are consistent with the expected frequencies based on a discrete uniform distribution.

2.

O	12	28	32	15	5	3
E	19.69	34.29	22.59	11.98	4.01	0.99

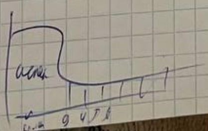
a) H_0 : good model

H_1 : not good

$$\chi^2 = \frac{(12-19.69)^2}{19.69} + \frac{(28-34.29)^2}{34.29} + \dots + \frac{(8-5)^2}{5} = 4.99$$

$\nu = 4$.

$\chi^2_4(5\%) = 9.488$



Accepted.

6 Increase values of the table.

3. a.

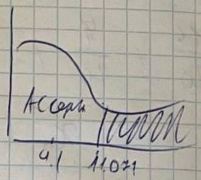
H_0: data modelled by Poisson distr

H_1: not by Poisson.

$$\chi^2 = \frac{(12-13.53)^2}{13.53} + \frac{(23-22.02)^2}{22.02} + \dots + \frac{(5-5.27)^2}{5.27} = 4.1$$

$v = 5$.

$\chi^2_5(5\%) = 11.071$



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~~4.~~ H_0 b) By calculated the value of λ, we will have additional parameter to estimate. So it will decrease degree of freedom. $v = 4$

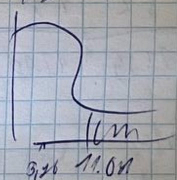
4. H_0: uniform

H_1: not uniform. $\alpha = 5\%$ $E = 12$.

$$\chi^2 = \frac{(15-12)^2}{12} + \frac{(23-12)^2}{12} + \dots + \frac{(11-12)^2}{12} = 5.76$$

$v = 5$.

$\chi^2_5(5\%) = 11.071$



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5. a) $\bar{x} = \dfrac{0 \cdot 15 + 13 \cdot 2 \cdot 9 + 3 \cdot 13 \cdot 4 \cdot 0}{50} = 1.4$

б) $P(0) = \dfrac{e^{-1.4} \cdot 1.4^0}{0!} = 0.2466$. $E_0 = 0.2466 \cdot 50 = 12.330$

$P(1) = 0.3452$ $E_1 = 17.262$

$P(2) = 0.2417$ $E_2 = 12.083$

$P(3) = 0.1128$ $E_3 = 5.639$

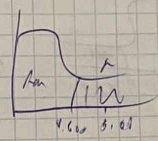
$P(4) = 0.0395$ $E_4 = 1.974$

$P(\geq 5) = 1 - (P \leq 4) = 0.01424$ $E_{\geq 5} = 0.71$

$\chi^2 = 5.04$

$\nu = 2$

$\chi^2_2(10\%) = 4.605$



rejected

6. $\mu = np$ $\mu_e = \dfrac{26 + 92 + 60 + 48 + 30 + 12}{100} = 2.4$

$p = \dfrac{\mu}{n} = \dfrac{2.4}{6} = 0.4$

$P(X = x) = \binom{n}{x} \cdot p^x (1-p)^{n-x}$

$P(0) = \binom{6}{0} \cdot 0.4^0 \cdot 0.6^6 = 0.0467$. $E_0 = 4.67$

$P(1) = \binom{6}{1}$ 0.1866 $E_1 = 18.66$

$P(2) = 0.3110$ $E_2 = 31.1$ $P(3) = 0.2765$ $E_3 = 27.65$

$P(4) = 0.1382$ $E_4 = 13.82$ $P(5) = 0.0369$ $E_5 = 3.69$

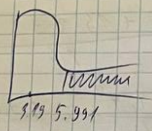
$P(6) = 0.004$ $E_6 = 0.4$

We will unite $P(6) + P(5) + P(4)$ [illegible] 5

$x^2 = 3.19$

$V = 4 - 2 = 2$

$x^2_2(5\%) = 5.991$



Accepted.

7. $M = \frac{81}{15} = 5.4$

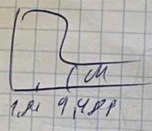
$E_1 = 5.4 \cdot 4 = 21.6$ $E_2 = 16.2$

$E_3 = 27$ $E_4 = 5.4$ $E_5 = 10.8$

$x^2 = \frac{(22 - 21.6)^2}{21.6} + \ldots + \frac{(12 - 10.8)^2}{10.8} = 1.84$

$V = 4$

$x_4^2(5\%) = 9.488$



Accepted.

8. $\bar{X} = \frac{276}{80} = 3.45$

$P(X = x) = \frac{e^{-\lambda} \cdot \lambda^x}{x!}$ $P(0) = 0.0318$

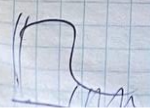
$P(1) = 0.11$ $P(2) = 0.1899$ $P(3) = 0.2175$

$P(4) = 0.1874$ $P(5) = 0.1293$ $P(6) = 0.074$

$P(7) = 0.0366$ $P(\geq 8) = 0.0249$

O	10	15	18	19	13	10
E	11.502	15.114	12.34	11.80	10.34	10.468

$x^2 = 0.99$ $x_5^2(5\%) = 9.488$



Accepted

9 $\lambda = \frac{99.5}{100} = 0.995$

$P(0) = \frac{e^{-0.99} \cdot 0.995^{0}}{0!} = 0.3867$, $E_0 = 38.67$

$P(1) = 0.3624$ $E_1 = 36.24$ $P(2) = 0.17442$

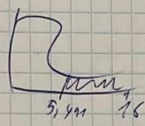
$P(3) = 0.0552$ $P(4) = 0.01312$

Ums $P(\geq 3) = P(4) + P(3)$.

$\chi^2 = 16$.

$V = 2$.

$\chi^2_{2}(0.05) = 5.991$



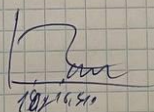
Rejected

16. $\bar{x} = \frac{505}{10} = 50.5$

$\chi^2 = \frac{(56-50.5)^2}{50.5} + \ldots + \frac{(50-50.5)^2}{50.5} = 16.7$.

$V = 10 - 1 = 9$

$\chi^2_{9}(5\%) = 16.919$



Accept.