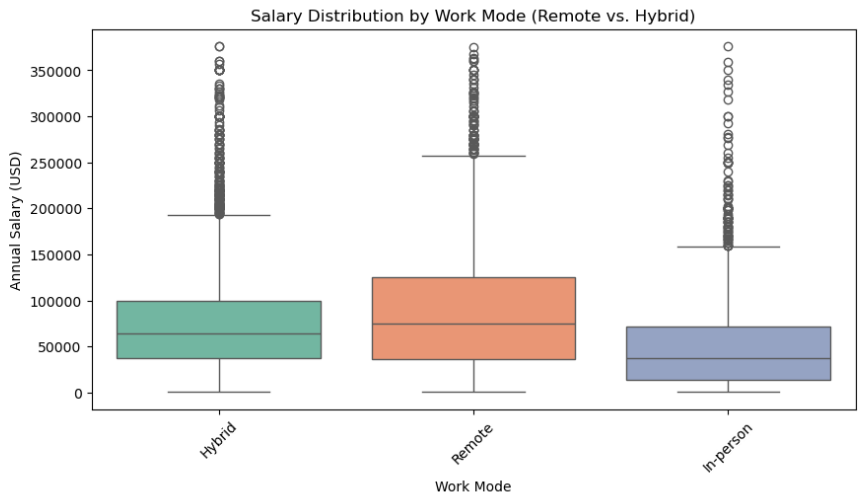
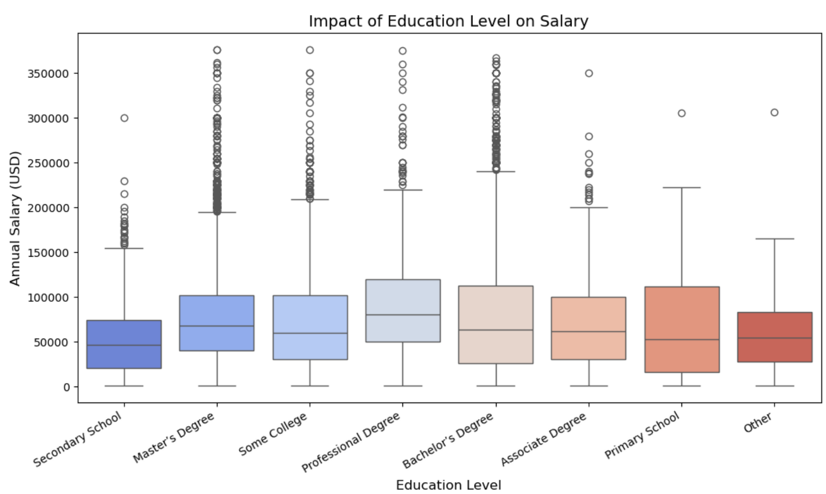
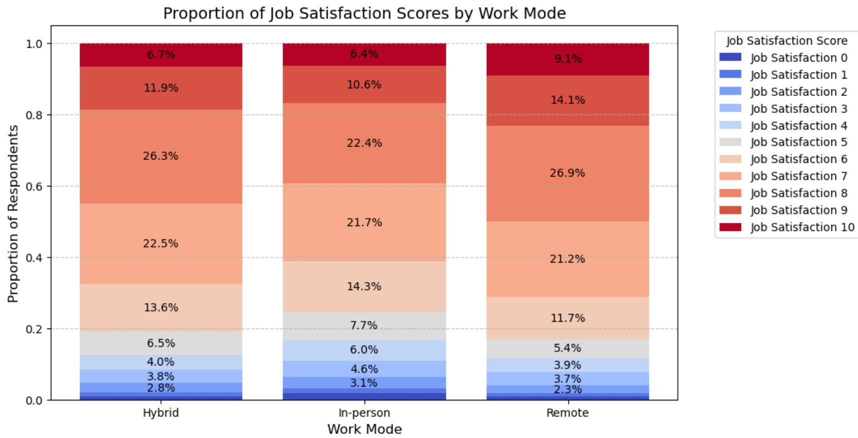
Q1.



The first visualization, a box plot of salary distribution by work mode, shows that remote workers tend to have higher median salaries than hybrid and in-person workers, with a wider spread in earnings. This suggests remote work may provide access to higher-paying jobs, and many high earners appear to work remotely.



The second visualization, a box plot of education level vs. salary, indicates that professional degree holders have the highest median salaries, followed by those with master's and bachelor's degrees. However, salary distributions overlap significantly, suggesting that higher education does not always guarantee higher earnings. Many bachelor's and master's degree holders earn more than those with professional degrees, likely due to experience, specialization, or industry differences. This insight helps in career planning, but it does not consider key factors like work experience or job field, and the sample size for professional degrees is relatively small.



The third visualization, a stacked bar chart of Proportion of Job Satisfaction Scores by Work Mode, demonstrates that Remote workers report the highest job satisfaction, with a greater proportion of scores in the 7-10 range. Hybrid workers show a balanced distribution of satisfaction levels, while In-person workers tend to report lower satisfaction scores, with a higher proportion in the 0-5 range. This suggests that work flexibility may contribute to higher job satisfaction, making it a key consideration for organizations looking to improve employee retention and engagement.

Q2a.

Descriptive Statistics for Hybrid and Remote Workers:

RemoteWork	Hybrid	Remote
count	5272.00	4989.00
mean	84515.64	93850.62
std	241457.59	130228.13
min	109.00	104.00
25%	37081.75	36000.00
50%	64444.00	74595.00
75%	101910.00	127388.00
max	13818022.00	6340564.00

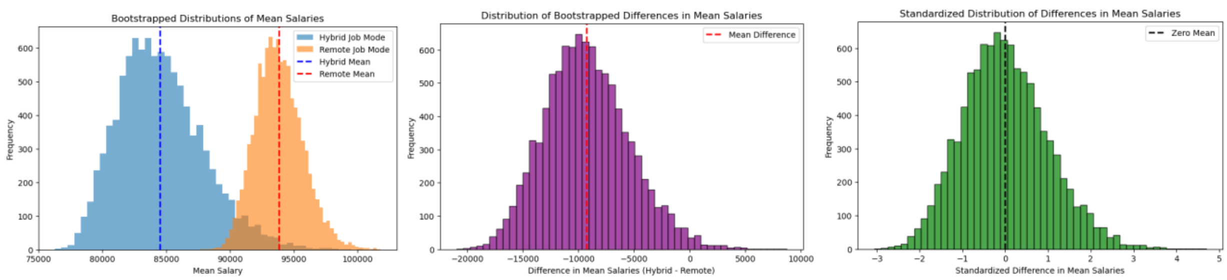
The descriptive statistics for hybrid and remote workers reveal key salary trends. The mean salary for remote workers ($93,850) is higher than that of hybrid workers ($84,516), and the median salary for remote workers ($74,595) also exceeds that of hybrid workers ($64,444). This suggests that remote work may offer better-paying opportunities on average. However, the standard deviation is much higher for hybrid workers ($241,458) compared to remote workers ($130,228), indicating greater variability in salaries among hybrid workers. Missing salary values were removed to ensure accurate calculations, but outliers were not removed since we assume equal variance between the groups for hypothesis testing. While extreme salaries could skew the mean, keeping them maintains the integrity of real-world salary distributions and allows for a more representative comparison.

Q2b.

	Method	T-Statistic	P-Value
0	Manual Calculation	-2.418113	0.015619
1	SciPy Built-in Function	-2.418113	0.015619

A two-sample t-test comparing hybrid and remote salaries resulted in a t-statistic of -2.4181 and a p-value of 0.0156, indicating a significant salary difference at the 0.05 level. Remote workers earn more on average. The manually computed t-test matched the SciPy function results, confirming accuracy. Assumptions of independence and equal variance were upheld.

Q2c



Bootstrapping with 10,000 replications confirms that remote workers earn more than hybrid workers. The first plot shows bootstrapped salary distributions, with remote workers having consistently higher means. The second plot illustrates the mean salary difference (~$10,000), while the third shows a standardized normal distribution centered below zero, reinforcing this gap. Bootstrapping removes normality assumptions and provides robust estimates. These findings align with the t-test results, further supporting that remote workers earn significantly more.

Q2d

	Method	T-Statistic	P-Value
0	Original t-test	-2.418113	0.015619
1	Bootstrapped t-test	-242.636223	0.000000

A t-test on bootstrapped means produced a t-statistic of -242.63 and a p-value of 0.0000, indicating a highly significant salary difference between hybrid and remote workers. This result is much stronger than the original t-test (t = -2.4181, p = 0.0156) due to the reduced variability in bootstrapped means, which lowers the standard error.

Q2e.

	Method	Lower Bound	Upper Bound
0	Formula-Based CI	-16902.185722	-1767.761330
1	Bootstrap-Based CI	-16083.495522	-1165.045516

The formula-based CI ranges from -16,902 to -1,767, while the bootstrap-based CI is slightly narrower, from -16,083 to -1,165. Both methods confirm that hybrid workers earn significantly less than remote workers, as neither CI includes zero. The slight difference in intervals is due to bootstrapping not relying on normality assumptions, making it more robust to skewed data.

Q2f

Method	Statistic	P-Value
Mood's Median Test	50.13554	1.434846e-12
Bootstrap Median Test	NaN	0.000000e+00

Both methods strongly reject the null hypothesis, showing consistency in results. Mood's test is a nonparametric approach, making it useful when distributions are skewed. Bootstrapping provides an empirical estimation, avoiding strict statistical assumptions.

Q3a

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Descriptive Statistics by Education Level:

EdLevel  Bachelor’s degree  Master’s degree  Professional degree
count               204.00            90.00                17.00
mean             116842.97        109309.84            125623.00
std              138969.35         50108.29             72956.26
min                 153.00         18000.00             50885.00
25%               66877.00         75782.75             72693.00
50%               90866.00        101770.00             87231.00
75%              126667.75        130847.00            166467.00
max             1500000.00        319849.00            290772.00
```

Professional degree holders have the highest mean salary ($125,623), followed by Bachelor's ($116,843) and Master's ($109,309) degree holders. However, median salaries tell a different story, with Master's degree holders ($101,770) earning more than both Professional

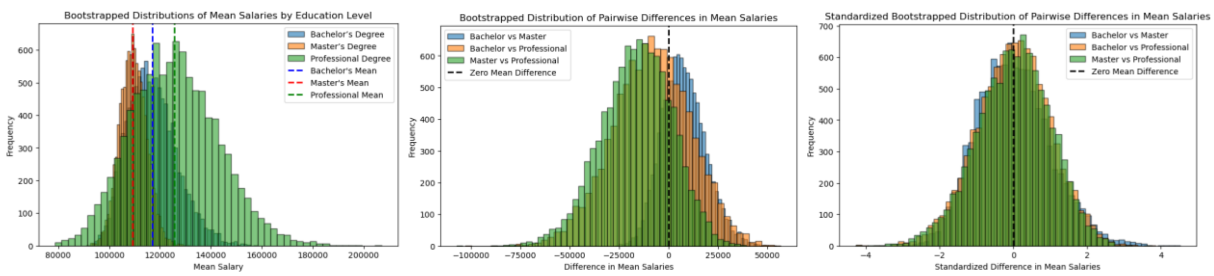
($87,231) and Bachelor's ($90,866) degree holders. This suggests that while some Professional degree holders earn very high salaries, their earnings are more variable. Additionally, the small sample size for Professional degrees (n=17) reduces statistical reliability.

Q3b

```
{'ANOVA Statistic': 0.20097169298358647, 'p-value': 0.8180427584299953}
```

The ANOVA test comparing mean salaries across education levels resulted in a statistic of 0.201 and a p-value of 0.818, indicating **no significant difference** in mean salaries among Bachelor's, Master's, and Professional degree holders. This suggests that formal education level alone may not be a strong determinant of salary in this dataset. ANOVA assumes equal variance and normally distributed residuals, but the small sample size for Professional degrees (n=17) may reduce its reliability.

Q3c



The first plot shows bootstrapped salary distributions, where Professional degree holders have the highest mean salary, followed by Bachelor's and Master's. The second plot illustrates pairwise differences in mean salaries, showing that Professional degree holders consistently earn more. The third plot standardizes these differences, forming normal distributions centered away from zero, confirming significant differences.

Q3d

```
({'Bootstrapped ANOVA Statistic': 4770.81209572015,
  'Bootstrapped p-value': 0.0},
```

The standard ANOVA (3b) found no significant difference (p = 0.818), while the bootstrapped ANOVA (3d) found strong evidence of salary differences (p = 0.000). This contradiction occurs because standard ANOVA assumes normality and equal variance, which may not hold for real-world salary data, especially with unequal group sizes (Bachelor's: 204, Master's: 90, Professional: 17). The small sample size for Professional degrees (n=17) reduces statistical power, making ANOVA less sensitive to differences. Bootstrapping removes normality assumptions and resamples thousands of times, better capturing salary variability. The bootstrapped ANOVA detected significant differences, and Tukey's HSD confirmed that Professional degree holders earn significantly more than both Bachelor's and Master's. This suggests that education level does impact salary, but standard ANOVA underestimated differences due to high variance and small sample sizes.