C. DETAILED OUTLINE

I. Question 1

A. **Introduction to country group** (2-3 first sentences):

- Summarize key economic statistics
- Incorporate additional data from external sources

Examples:

Upper-middle income Asian countries experienced 5% average GDP growth and 3% inflation over the past decade. HDI is 0.7 while Gini coefficient is 38, indicating uneven development and income distribution.

B. **Data source overview** (4-5 next sentences)

- Brief background on World Development Indicators
- Present summary statistics in a table
- Interpret and explain the meaning of statistics

Examples:

The World Development Indicators compiled by the World Bank provide high-quality and comprehensive global data on development. For this lower-middle income sample, mean GDP is $550 billion, median is $75 billion, and standard deviation is $900 billion, indicating wide variation in economic size. Mean per capita GDP is $2,100, while average inflation is 5% over the past decade.

C. **Histograms** (4-5 next sentences)

- Create histograms for GDP, GDP per capita, and inflation
- Discuss shape, center, spread, outliers of distributions
    - How this shape links to your chosen country group.
    - Does this shape make

Examples:

The GDP histogram is right-skewed, with most countries clustered under $500 billion but a few outliers over $2 trillion shifting the mean higher. GDP per capita shows a normal

bell-shaped distribution centered on the mean of $2,100. The inflation histogram is somewhat left-skewed with a tail from a few high inflation countries, but most centered between 2-7%.

II. Question 2

A. 95% CI for HDI and Gini

Steps to construct 95% confidence interval

Step 1: Calculate the sample mean ($\bar{x}$) and sample standard deviation (s) of the values.

Step 2: Identify the relevant t-statistic based on the sample size and desired confidence level. For a 95% CI with a large sample, the t-statistic will be approximately 1.96.

Step 3: Calculate the margin of error (ME) using the formula:

$$ME = \text{t-statistic} * (s / \sqrt{n})$$

Where n is the sample size.

Step 4: Calculate the lower and upper bounds of the confidence interval as:

$$\text{Lower bound} = \bar{x} - ME$$

$$\text{Upper bound} = \bar{x} + ME$$

Step 5: Construct the 95% confidence interval as: (Lower bound, Upper bound)

Examples:

For example, if the sample mean HDI is 0.68, the standard deviation is 0.12, and the sample size is 80, the 95% CI would be:

$\bar{x} = 0.68$

$s = 0.12$

$n = 80$

t-statistic = 1.96

$ME = 1.96 * (0.12/\sqrt{80}) = 0.043$

Lower bound = 0.68 - 0.043 = 0.637

Upper bound = 0.68 + 0.043 = 0.723

95% CI = (0.637, 0.723)

So we can be 95% confident the true population mean HDI lies between 0.637 and 0.723 based on our sample data.

State and interpret confidence intervals *(2-3 next sentences)*

Examples:

The 95% confidence interval for HDI is 0.60 to 0.66, implying the true population mean HDI likely lies between those bounds. The 95% CI for Gini coefficient ranges from 36 to 41, indicating the true income inequality level is likely in that interval.

B. Assess normality (7-9 next sentences)

HDI

- Visually inspect histogram shape for symmetry and outliers
- Conduct normality test (e.g. Shapiro-Wilk)
    - State null and alternative hypotheses
    - Interpret p-value to determine if null of normality can be rejected
- Based on visual inspection and test, assess if normal distribution can be assumed

Examples:

- The HDI histogram appears relatively symmetric and unimodal. No severe outliers are present.
- The Shapiro-Wilk test yields a p-value of 0.46, meaning the null hypothesis of normality cannot be rejected at the 5% significance level.
- Based on the visual inspection and statistical test, the HDI values appear sufficiently normal to proceed under the normality assumption.

Gini Coefficient

- Visually inspect histogram shape
- Conduct normality test
    - Interpret results
- Assess if normality can be assumed

Examples:

- The Gini coefficient histogram is moderately right skewed rather than symmetric.
- The Shapiro-Wilk test gives a p-value of 0.03, leading to rejection of normality at the 5% significance level.
- The visual and statistical evidence suggests normality is not a reasonable assumption for the Gini coefficient.

C. Compare 95% vs 99% CIs

Here are the steps to construct a 99% confidence interval and compare it to a 95% confidence interval:

1. Calculate the sample mean ($\bar{x}$) and sample standard deviation (s) for each variable.
2. Identify the t-statistic corresponding to the 99% confidence level. For a large sample, this will be approximately 2.58 rather than 1.96 for a 95% CI.
3. Calculate the margin of error (ME) using the 99% t-value:

ME = 2.58 * (s / √n)

4. Calculate the 99% CI bounds:

Lower bound = $\bar{x}$ - ME Upper bound = $\bar{x}$ + ME

5. Construct the 99% CI.
6. Compare the 99% CI width to the 95% CI width.

- The 99% CI will have a larger ME due to the higher t-statistic, making the interval wider.
- This reflects the higher confidence level - we want to be more certain the true mean falls within the wider 99% CI.
- The tradeoff is lower precision, as the interval provides a less precise range estimate.

In summary, the 99% CI will be wider than the 95% CI for both variables, indicating less precision but greater confidence the population mean is contained in the interval.

III. Question 3

A. **Describe HDI calculation** (6-8 first sentences)

- Succinctly explaining the HDI's composition and the interpretation of the final index value

Examples:

The Human Development Index (HDI) measures development through three dimensions: health, education, and living standards. Health is represented by life expectancy at birth. Mean and expected years of schooling are proxies for education attainment. Income per

capita represents living standards. Each indicator is normalized on a 0 to 1 scale using observed global minimum and maximum values. The dimension indices are averaged to compute the overall HDI score, which ranges from 0 to 1. Higher HDI values signify greater human development. An HDI of 0.75 means development is 25% below the highest level worldwide. The HDI provides a broader measure of development than just income.

B. Hypothesis testing for HDI

Here are the steps to test if the population mean HDI is greater than 0.5 at the 5% significance level:

1. Calculate the sample mean ($\bar{x}$) and standard deviation (s) of the HDI data.
2. State the hypotheses:

H0: $\mu \leq 0.5$ Ha: $\mu > 0.5$

Where μ is the population mean HDI.

3. Calculate the t-statistic:

$t = (\bar{x} - 0.5) / (s / \sqrt{n})$

4. Compare the t-statistic to the critical value from the t-distribution with n-1 degrees of freedom at the 5% significance level.
5. If the t-statistic is greater than the critical value, reject the null hypothesis. Otherwise, fail to reject the null.
6. Interpret the result in context of the problem. Rejecting H0 suggests evidence the population mean HDI exceeds 0.5. Failing to reject means insufficient evidence at the 5% level that the mean is greater than 0.5.
7. Report the p-value and whether H0 can be rejected at the 5% significance level.

C. Compare significance levels (6-8 first sentences)

Results comparison

- Conduct the test again using a 1% significance level rather than 5%.
- The critical value will be larger at the 0.01 level, making it harder to reject the null hypothesis.
- If the test conclusion changes from reject to fail to reject when using 0.01, it indicates the evidence is strong enough to reject at 5% but not at 1%.
- For many applications, the 5% level is more commonly used and provides reasonable evidence to reject the null.

- The 1% level requires very strong evidence to reject. It reduces the risk of falsely rejecting, but also reduces power.

Significance level selection

- There is often no definitively "right" choice. Selecting the significance level depends on the context, consequences, and tradeoff between false positives and false negatives.
- For an exploratory macroeconomic analysis, 5% seems appropriate. But for policy decisions with major impacts, the 1% level may be justified.

D. TIPS & TRICKS

Writing Tips:

- Carefully follow the required structure and explicitly address each component of the questions.
- Concisely explain your methodology, results, and interpretation. Avoid rambling text.
- Define key terms and concepts when mentioned for the first time.
- Link analysis back to economic context and significance.
- Use headings and formatting strategies like bullet points to enhance readability.
- Cite data sources. Use proper references.

Data Visualization:

- Check that histograms effectively convey distribution shape and outliers.
- Use appropriate axis scales and labels on graphs.
- Title all tables and figures. Number them sequentially.
- Highlight key takeaways from visualizations in a brief discussion.
- Export graphs cleanly from RStudio. Do not use pixelated screenshots.

Analysis:

- Justify assumptions clearly, like using normal distribution for confidence intervals.
- Show all calculations. Use proper statistical notation and formulae.
- Interpret the meaning of test statistics, p-values, and confidence intervals.
- Double check code for errors. Test alternate model specifications.
- Relate analysis back to research objectives and economic context.

E/ REFERENCES

- Macroeconomic trends and outlook in Asia (Nikkei Asia): https://asia.nikkei.com/Editor-s-Picks/Interview/Asian-Development-Bank-sees-developing-Asia-growing-4.6-in-2022
- Analysis of inflation across emerging economies (Wall Street Journal): https://www.wsj.com/articles/emerging-markets-inflation-shocks-strain-economic-recoveries-from-covid-19-11658738602
- Human development trends in developing countries (World Economic Forum): https://www.weforum.org/agenda/2019/12/human-development-index-un-data-africa-economics/
- Macroeconomic determinants of the Human Development Index (Journal of Economic Development): https://www.jed.or.kr/full-text/39-1/2.pdf
- Inequality trends in developing countries (Journal of Globalization and Development): https://www.degruyter.com/document/doi/10.1515/jgd-2020-0023/html
- Macroeconomic effects of inflation (IMF Economic Review): https://www.palgrave.com/gp/journal/41288/articles/ecor201710
- Modeling macroeconomic indicators in emerging economies (Emerging Markets Finance and Trade): https://www.tandfonline.com/doi/abs/10.1080/1540496X.2019.1632822