Product type / Product	**Requested formatting**	**Checks**
Type: Free text	Single text block, enclosed within triple-backticks	- The response must include exactly one triple-backtick block from which the product is extracted. Feedback is provided for no blocks, multiple blocks, or incomplete blocks.
Research goal		No additional checks
Type: Structured text and binary decision	An evaluable Python object	- The response must include a textual representation of a Python object, extracted by its flanking characters ([], or {}). - The extracted textual representation must be an evaluable Python object. - The resulting Python object must be of the requested type (as defined below for each research step).
Literature search I − queries	A Python Dict[str, List[str]]	- The dictionary keys must be: 'dataset', 'questions'. - The dictionary values must be a list of strings each with a maximum of 10 words.
Goal validation	A Python Dict[str, str]	- The dictionary must include a single key: 'choice'. - The dictionary values must be either "OK" or "REVISE".
Hypothesis testing plan	A Python Dict[str, str]	- The dictionary must have at most 3 items. * A dictionary key which starts with the word `hypothesis`, is modified to remove this word.
Literature search II − queries	A Python Dict[str, List[str]]	- The dictionary keys must be: 'background', 'dataset', 'methods', 'results'. - The dictionary values must be a list of strings each with a maximum of 10 words.
Type: LaTex text	Single block of LaTex text enclosed within triple-backticks	- The response must include exactly one triple-backtick block from which the product is extracted. Feedback is extracted for no blocks, multiple blocks, or incomplete blocks. * Any citations with incorrect format are removed. * Any "floating citations", not enclosed with 'cite{}' are fixed to the correct format. * Any unescaped characters are getting escaped. - The extracted LaTex text does not include unwanted LaTex commands (`verb`, `\begin{figure}`, and `cite` which is only allowed in sections with citations). - The citations in the LaTex text that have the correct format are from the extracted list of citations given in the context messages. - The extracted LaTex text includes only the requested section. - The extracted LaTex text is compiled with no errors.
Data exploration − code explanation	```latex \section{Code Explanation} <your code explanation here> ```	No additional checks
Data analysis − code explanation	```latex \section{Code Explanation} <your code explanation here> ```	No additional checks
Title & abstract draft	```latex \title{<your latex-formatted paper title here>} \begin{abstract} <your latex-formatted abstract here> \end{abstract} ```	- The title does not include the ":" symbol. (soft rule - feedback is only provided once) - The abstract is written as a single paragraph ('\n' appears at most once in the abstract string). - The abstract does not include any URL addresses. - The abstract does not include any of the following phrases: 'Acknowledgments', 'Data Availability', 'Author Contributions', 'Competing Interests', 'Additional Information', 'References', 'Supplementary'. - The abstract does not include subsections.

Results	```latex \section{Results} <your latex-formatted writing here> ```	- The section must not include numeric values that were not provided in the conversation context (Methods). - The section does not include any of the following phrases: 'Acknowledgments', 'Data Availability', 'Author Contributions', 'Competing Interests', 'Additional Information', 'References', 'Supplementary', 'In conclusions', 'Future research', 'Future work', 'Future studies', 'Future directions', 'Limitations'. - The section does not include any URL addresses. - The section does not include any unknown result (marked by any of the following options '[unknown', '<unknown', '[insert', '<insert', '[missing', '<missing', '[to be', '<to be', 'xx', 'xxx'), requested to returned as '[unknown]' in the mission prompt). - The section must include specific references for each of the tables. - The section must not include subsections.
Title & abstract	```latex \title{<your latex-formatted paper title here>} \begin{abstract} <your latex-formatted abstract here> \end{abstract} ```	Same as for "Title * abstract draft" (above)
Methods	```latex \section{Methods} <your latex-formatted writing here> \subsection{Data Source} <your latex-formatted writing here> \subsection{Data Preprocessing} <your latex-formatted writing here> \subsection{Data Analysis} <your latex-formatted writing here> ```	- The section must include the requested subsections: 'Data Source', 'Data Preprocessing' and 'Data Analysis'. - The section must not include specific software versions. - The section does not include any URL addresses. - The section must not include any of the following phrases: 'Acknowledgments', 'Data Availability', 'Author Contributions', 'Competing Interests', 'Additional Information', 'References', 'Supplementary'.
Introduction	```latex \section{Introduction} <your latex-formatted writing here> ```	- The section must not include any URL addresses. - The section must not include any of the following phrases: 'Acknowledgments', 'Data Availability', 'Author Contributions', 'Competing Interests', 'Additional Information', 'References', 'Supplementary'. - The section must not include subsections.
Discussion	```latex \section{Discussion} <your latex-formatted writing here> ```	- The section must not include any URL addresses. - The section must not include any of the following phrases: 'Acknowledgments', 'Data Availability', 'Author Contributions', 'Competing Interests', 'Additional Information', 'References', 'Supplementary'. - The section must not include subsections.

Type: Python code	Single block of code enclosed within a triple-backtick	**Static checks:** - The response must include exactly one triple-backtick code block from which the code product is extracted. Feedback is provided for no blocks, multiple blocks, or incomplete blocks. **Runtime checks:** - Run encountered any syntax error, builtin Python runtime error or module runtime error. - Run encountered warnings of specified types (DeprecationWarning, ResourceWarning, and others). - Run does not complete within a user-specified duration. - Run attempts to open files that are not part of the numeric products provided. - Run attempts writing into files that are not part of the requested output files. - Run attempts to import potentially problematic modules, such as ‘os’, ‘sys’, etc. - Run calls any of a list of unallowed functions, including ‘print’, ‘input’, ‘eval’, etc. - Run does not contain ‘__name == '__main__'‘
Data exploration - code	Code should include the headers: # Data Size # Summary Statistics # Categorical Variables # Missing Values	- Code must include all the specified headers as comments.
Data analysis - code	Code should include the headers: # IMPORT # LOAD DATA # DATASET PREPARATIONS # DESCRIPTIVE STATISTICS # PREPROCESSING # ANALYSIS # SAVE ADDITIONAL RESULTS	- Code must include all the specified headers as comments.
Table design - code	Code should include the headers: # IMPORT # PREPARATION FOR ALL TABLES # TABLE 1 # TABLE 2 etc (for each table created in the "Data analysis" step.	- Code must include all the specified headers as comments. - Code must contain the imports of: to_latex_with_note, format_p_value, is_str_in_df and split_mapping.
Type: Numerical data		- The code must create the requested output files (see below for each step). - The code must not create any other files.
Data exploration − code output	**"data_exploration.txt"** An output text file. Must contain the following headers: # Data Size # Summary Statistics # Categorical Variables # Missing Values	- The created output file contains all the specified headers. - The created output file is not too large (less than 2500 tokens).

Data analysis − tables	**“table_?.pkl”** At least 2 output files, each containing a single dataframe representing a table for the paper.	- The code must create at least one file "table_?.pkl". - Each “table_?.pkl” file must contain a single dataframe. - Dataframe index must not be a numeric range (to make sure all rows are properly labeled). - Dataframe values must be either strings, numeric, bool, or tuple (to be able to convert them into LaTex in the “Table design” step). PValue objects are also allowed (Methods, Supplementary Table 5). - Dataframes must not include the same non-integer numeric value (to avoid overlap in table content). - Dataframes must not report ‘min’, ’max’, ‘mean’, ‘std’ and quantiles (this improper scientific presentation often occurs as ChatGPT code uses the pd.describe method). - Dataframe must not have any NaN values. - Dataframe must not exceed specified size (max of 10 columns and 20 rows).
Data analysis − other results	**“additional_results.pkl”** An output file containing a Python dict, representing analysis results needed for the paper in addition to the results provided in the tables.	- The code must create a file “additional_results.pkl”. - The file must contain a single object of type Dict[str, Any].
Tables design − tables	**“table_?.tex”** For each "table_?.pkl" file created in the "Data analysis" step, the Table design code must create a "table_?.tex" file, providing a scientifically-formatted LaTex representation of the table.	- A "table_?.tex" must be created for each "table_?.pkl" provided. - Each "table_?.tex" file compiles to Latex without errors. - The width of the compiled table must be within text margins. - The table must not have a column with the same int value (such as often happens in tables that list a “count” column from a pd.describe method). - The table must not have any PValue objects that were not converted to strings (to make sure ChatGPT builds into the code conversion of small p-values into “<1e-6” string; Methods, Supplementary Table 5). - The table has a valid caption. - The table has a valid label in the format “table:<tag>” (to allow citing the tables from the result section). - If the table has a footnote, the footnote must be different from the caption. - Table row and column headers do not contain certain unallowed characters, such as underscores. - The table has a legend with keys matching any label of rows or columns that has characteristics of an abbreviation (such as names that include more than two uppercase characters; and names that contain ‘., ‘:’, ‘_’ punctuation symbols). - The legend does not include keys that are not part of the column or row labels.