Building a GUI for Unix Commands Execution on MacOS

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

CSCI 6917: Guided Research

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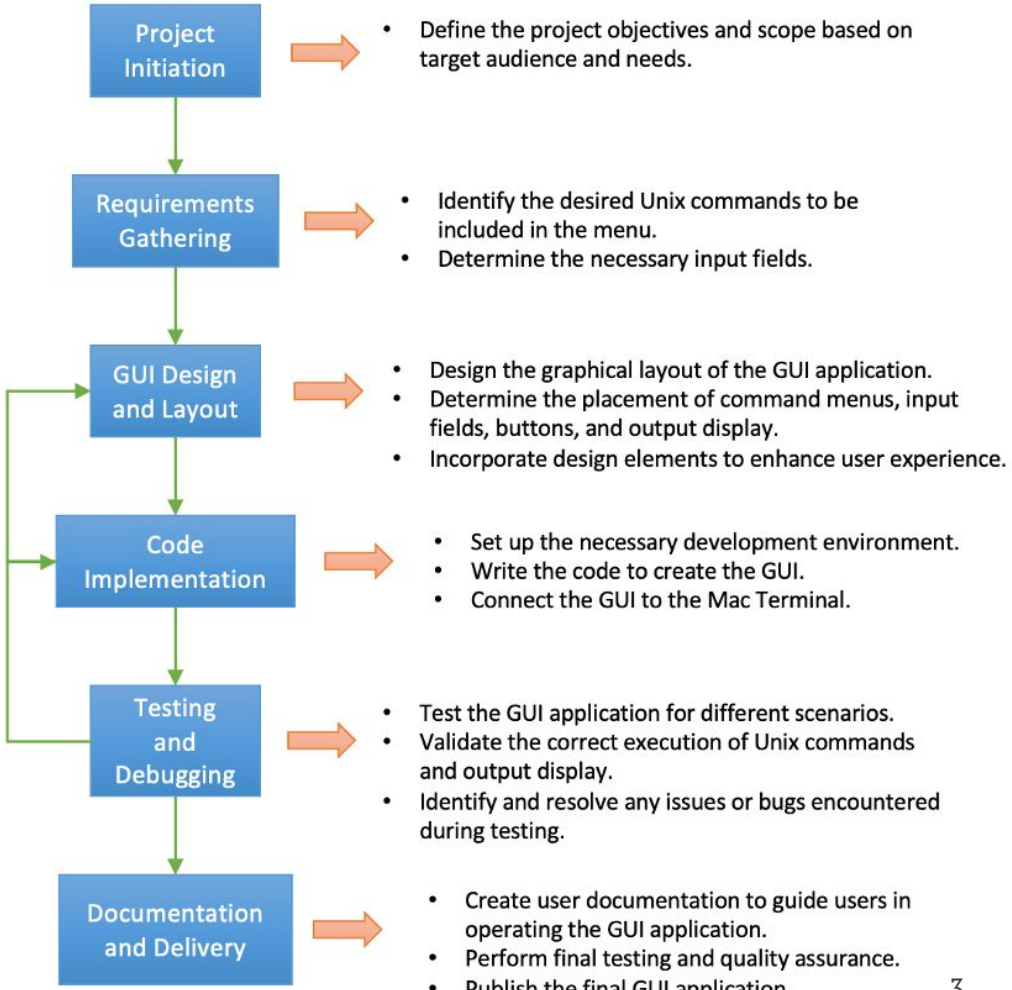
Project Objective

Heilmeier Questions

- Objective (What was I going to do?):
  - Develop a user-friendly graphical user interface (GUI) for executing Unix commands on MacOS.
- How is it done today? Current Limitations?
  - Users have to work directly into the Terminal which requires a pre-existing knowledge of Unix Command syntax and comfort with the Terminal.
- What was my idea to do something better? Who will benefit from my work?
  - Empowers novice users by simplifying the execution of Unix commands, by making it easier to explore and use Unix commands through an intuitive GUI that has instructions, tips, and an aesthetic user interface which overall saves time and effort.
- What risks do I anticipate?
  - Security vulnerabilities in command execution and insufficient error handling.
    - These were addressed through methods such as input validation and specified error alert messages.
- Out of pocket costs? Complete within timeline?
  - No real cost due to existing access to all necessary tools and a reasonable plan was formulated to stay on track.

Technical Approach

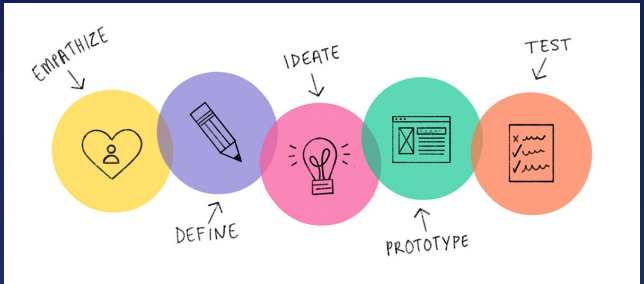
Project Flow



Technical Approach

Key Steps in Research

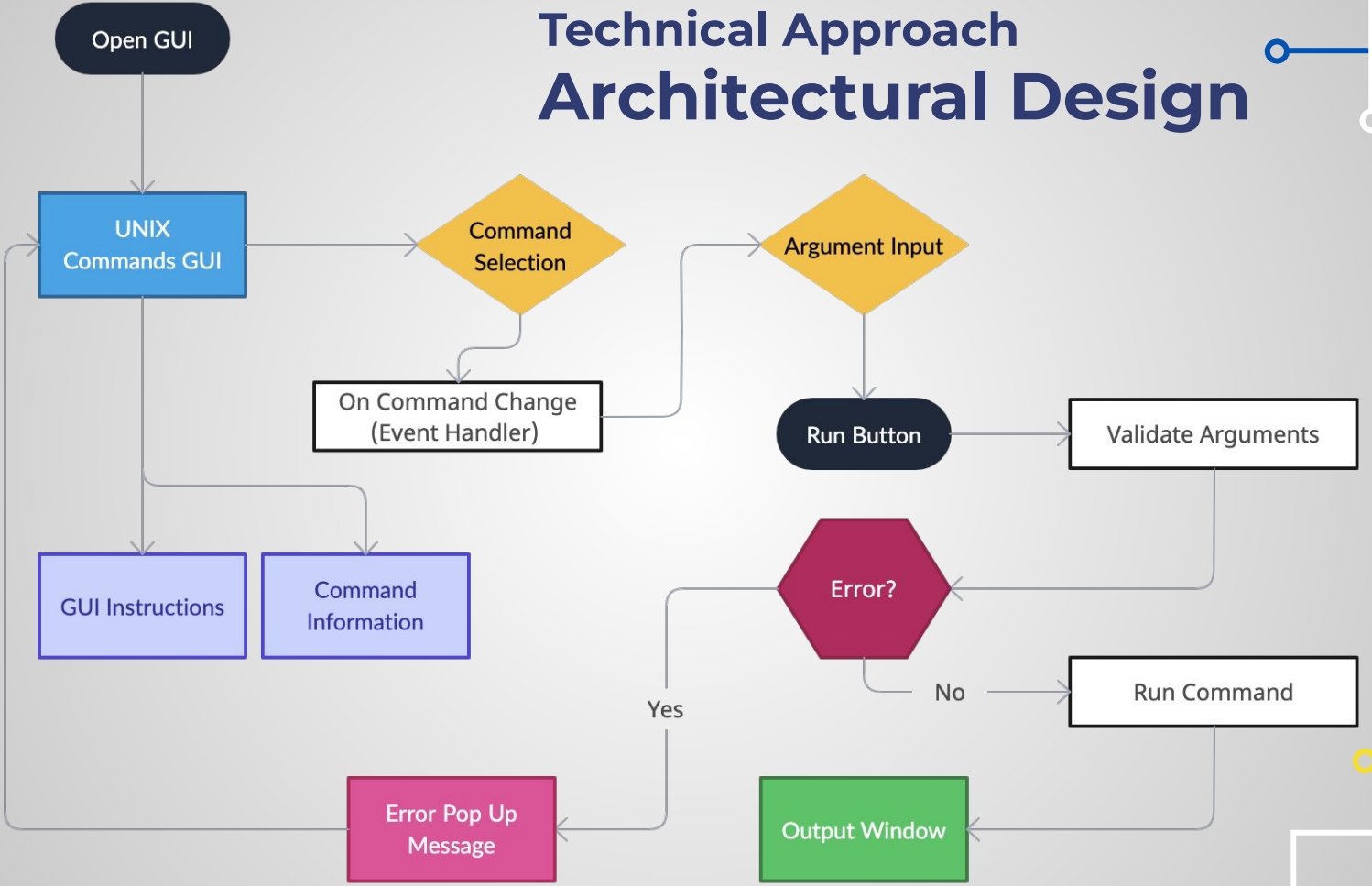
- Qualitative Approach
  - To focus on how to facilitate the user's needs and experience and improve through repeated testing.



- Explore GUI frameworks for MacOS.
  - PySimpleGUI and Tkinter.
- Choose relevant UNIX commands.
  - Research the most used and necessary for Terminal use.
- Design GUI layout and structure.
  - Format based on the needs of the commands.
- Implement menu-based command selection and argument input.
  - Develop command execution functionality.

Technical Approach

Architectural Design



Technical Approach
Code

```
commands = {
    'ls': {
        'description': 'List files and directories',
        'template': 'ls',
        'requires_arguments': False
    },
    'cd': {
        'description': 'Change directory',
        'template': 'cd <directory>',
        'requires_arguments': True
    },
    'mkdir': {
        'description': 'Create directory',
        'template': 'mkdir <directory>',
        'requires_arguments': True
```

```
def validate_arguments(command, arguments):
    if not command:
        return False, "Please select a command."

    if command not in commands:
        return False, "Invalid command selected."

    if commands[command]['requires_arguments'] and not arguments:
        return False, "This command requires arguments. Please provide them."

    if not commands[command]['requires_arguments'] and arguments:
        return False, "This command does not require arguments. Please remove them."

    return True, ""
```

Technical Approach
Code

```
content_frame = ttk.Frame(root)
content_frame.pack(padx=20, pady=20)

command_label = ttk.Label(content_frame, text='Command:')
command_label.grid(row=0, column=0, sticky=tk.W)

command_combo = ttk.Combobox(content_frame, values=list(commands.keys()), state='readonly', width=30)
command_combo.grid(row=0, column=1, padx=5, pady=5)
command_combo.bind('<<ComboboxSelected>>', on_command_change)

arguments_label = ttk.Label(content_frame, text='Arguments:')
arguments_label.grid(row=1, column=0, sticky=tk.W)

arguments_entry = ttk.Entry(content_frame, width=30)
arguments_entry.grid(row=1, column=1, padx=5, pady=5)

run_button = ttk.Button(content_frame, text='Run', command=run_button_click)
run_button.grid(row=2, column=0, columnspan=2, padx=5, pady=10)
```

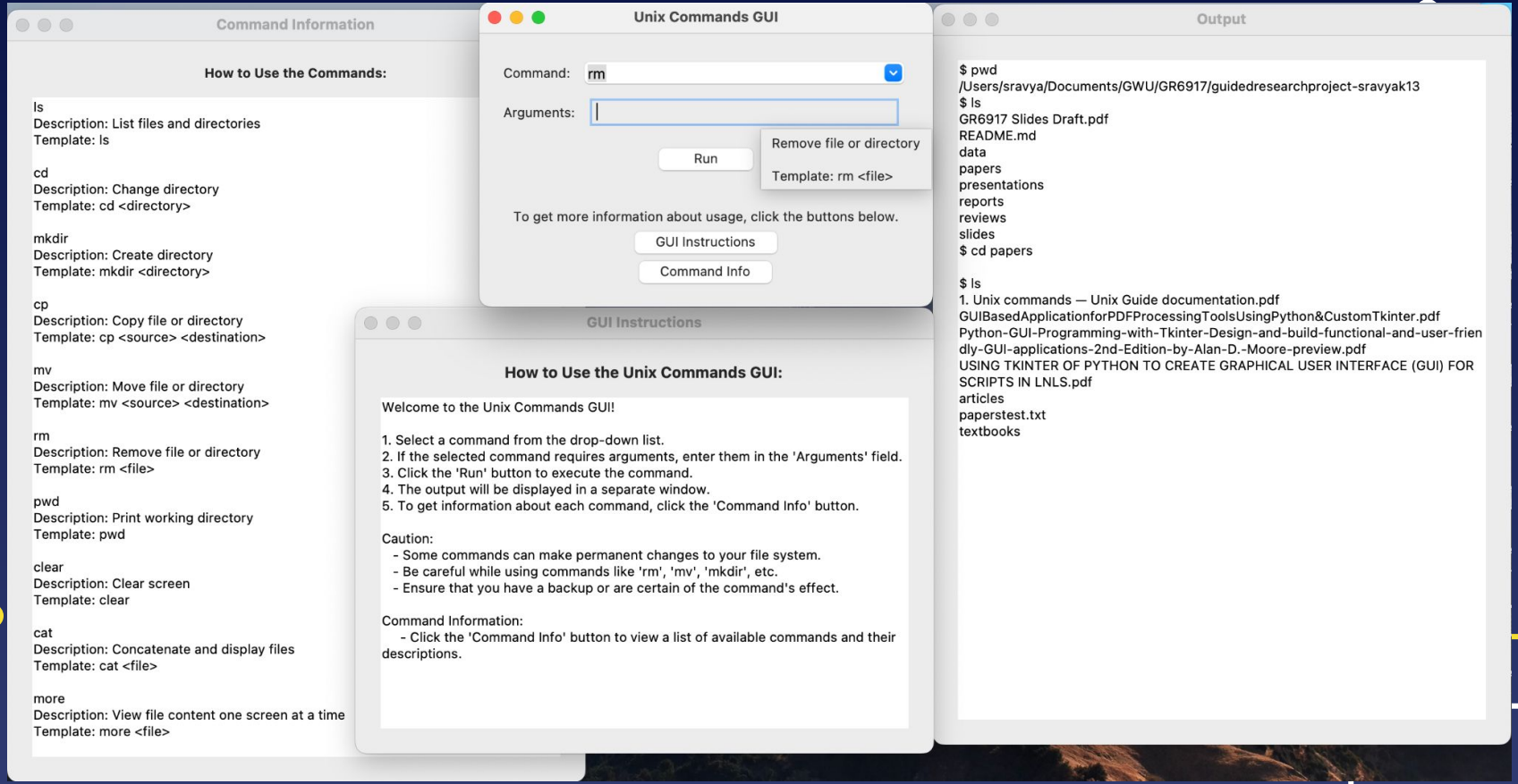
```
tooltip_toplevel = tk.Toplevel(root)
tooltip_toplevel.withdraw()
tooltip_toplevel.overrideredirect(True)
tooltip_toplevel.attributes('-topmost', True)

tooltip_label = ttk.Label(tooltip_toplevel, background="#ffffe0", borderwidth=0, relief=tk.SOLID, padding=(10, 5), wrapleng
tooltip_label.pack()
```

Technical Approach

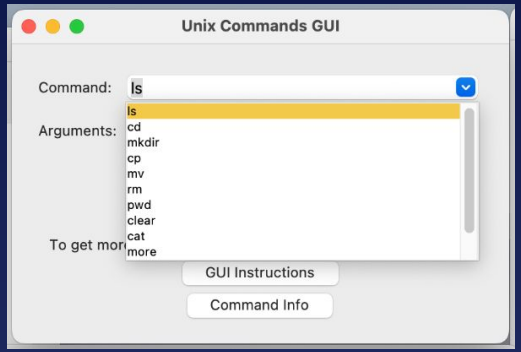
Innovative Approach

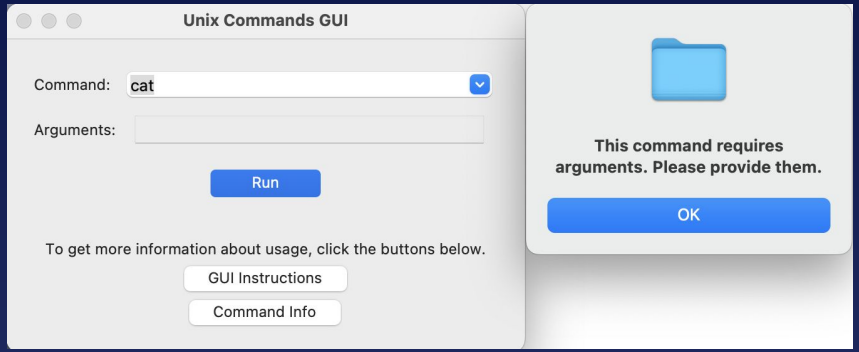
- User-Friendly Experience using a Graphical User Interface (GUI):
  - The GUI interface makes Unix commands accessible and intuitive for users unfamiliar with the command-line interface.
- Menu-Based Command Selection:
  - Simplifying command execution by allowing users to choose commands from dropdown menus.
- Argument Prompting:
  - Guiding users to input required arguments for each command, reducing errors and improving command context.
- Robust Error Handling:
  - Providing informative and actionable feedback for users when errors occur during command execution.
- Security Considerations:
  - Emphasizing safety by warning users about potentially harmful commands (Ex: 'rm')

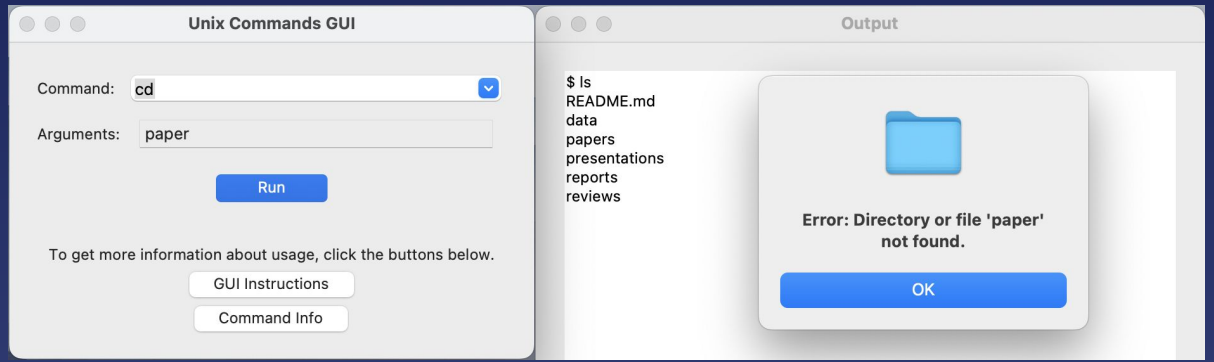
Results
Example



Results
Example

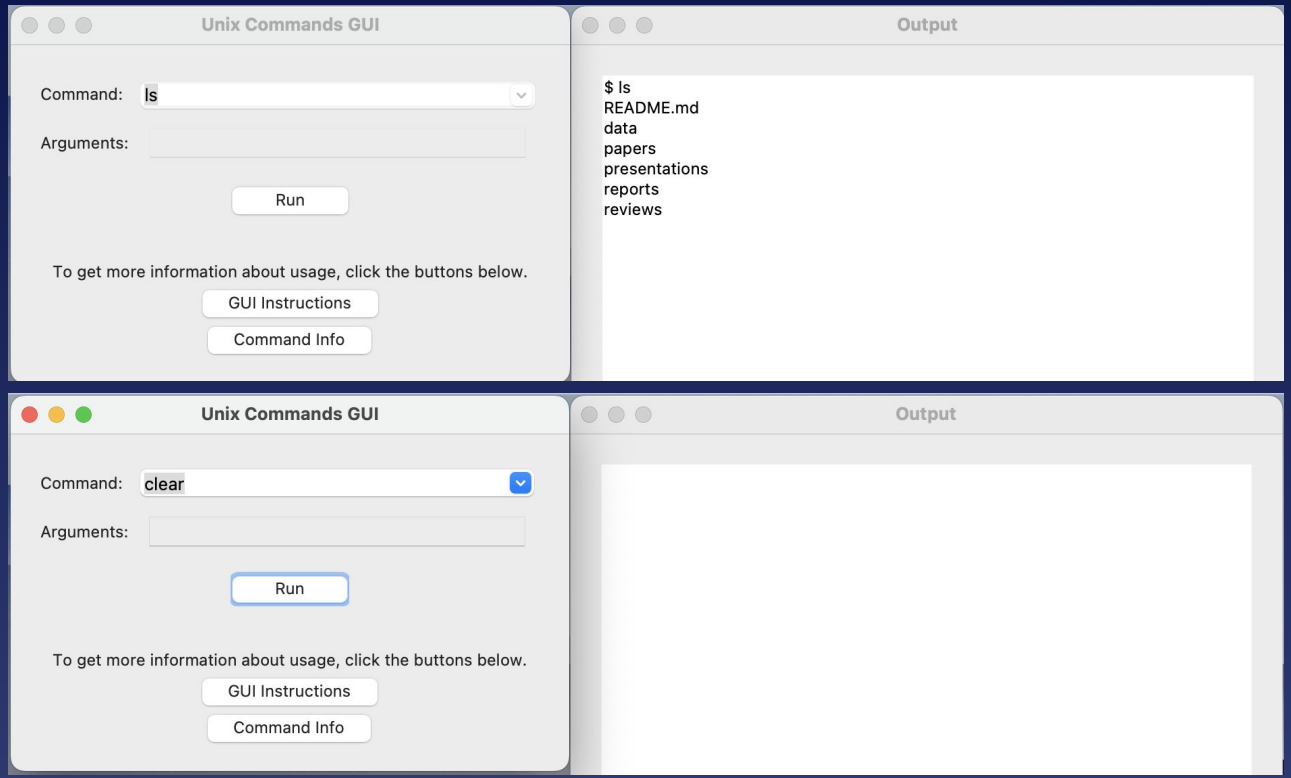






Results
Example

```
def clear_output_window():
    output_text.configure(state='normal')
    output_text.delete(1.0, tk.END)
    output_text.configure(state='disabled')
```



Conclusion

- The development of a graphical user interface (GUI) for executing Unix commands on MacOS offers a user-friendly alternative to the traditional command prompt in multiple ways.
  - Menu-based command selection and argument prompting:
    - Simplifies the process of running Unix commands, making it accessible to novice users.
  - Error handling mechanisms and informative feedback:
    - Enhances the GUI's reliability and helps users understand and rectify potential errors.
  - Bridges the gap between technical complexity and user accessibility.**

- Overall, this project has been successful in its mission to make Unix commands more user-friendly and efficient on MacOS.
  - There was some difficulty along the way with GUI development and integration with the Terminal, as well as with defining certain aspects of the research.
    - However, this was addressed by taking more time for research and discussing with the Professors as needed.

Future Work

UNIX®
An Open Group Standard

- Interactive Tutorial
- Expand Command Support
- Tracking Features
  - Save Output to File
  - Error Logging and Reporting
  - Command History
- Syntax Highlighting
  - Make different aspects more easily identifiable
- Macro Commands
  - Ability to bundle several commands together

Thank you!

Questions?