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# Project Report

**Introduction**:

For our project, we wanted to create a program that would allow students to input their interests (departments, domains, professors, etc.) and the program would output a list of classes based on relevance to their inputted interests. Throughout working on our project though, we realized given our time, knowledge, and resources this wasn't feasible. Our final product is a program that will generate course suggestions for students at Haverford, based on requirements they need to fill (domain and coure level). Our motivation for this project is that we've all had trouble finding classes that fulfill requirements we need (especially domain courses as Bionic does not allow students to filter courses based on domains) and we wanted to create a program that addresses this issue. We wanted to implement unique features that fit what we would want on a course recommendation website. This project helped us learn to create a graphical user interface while solving our problem by creating a program that generated courses based on requirements we need to fill.

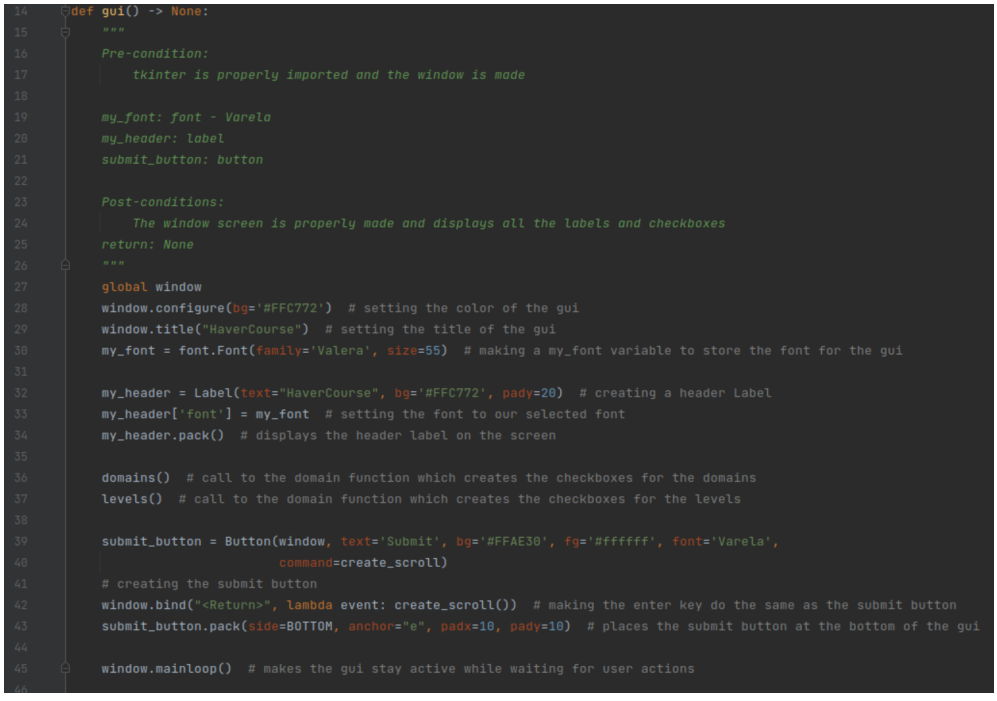
**Methodology**:

HaverCourse required different functions and the GUI aspect of the code demanded a special python library called tkinter. Tkinter allows users to add buttons, labels, checkboxes to build a user interface. We also used two other libraries called typing and csv. The library typing in Python provides support to type hints. Type hints is a tool to help catch errors by providing

information about the expected types of values in the code. Lastly, the CSV library allowed us to read and use and sort through our CSV file of Haverford courses. We used 3 different modules for this project, a main module, a sort_functions module, and a display_screen_GUI. In the main.py module we have the function GUI where we have set up the colors, fonts, the labels, the checkboxes, and where everything is placed in the GUI. The Sort_Function.py reads the CSV file then filters the data, removing unwanted courses. Finally, it filters the data into domains then sub divides the domains into levels. The display_screen_GUI.py module contains the code for displaying the results for the user. We had a total of 13 functions which helped with readability and easy debugging.

**Results**: screenshots of the code in action and add short comments

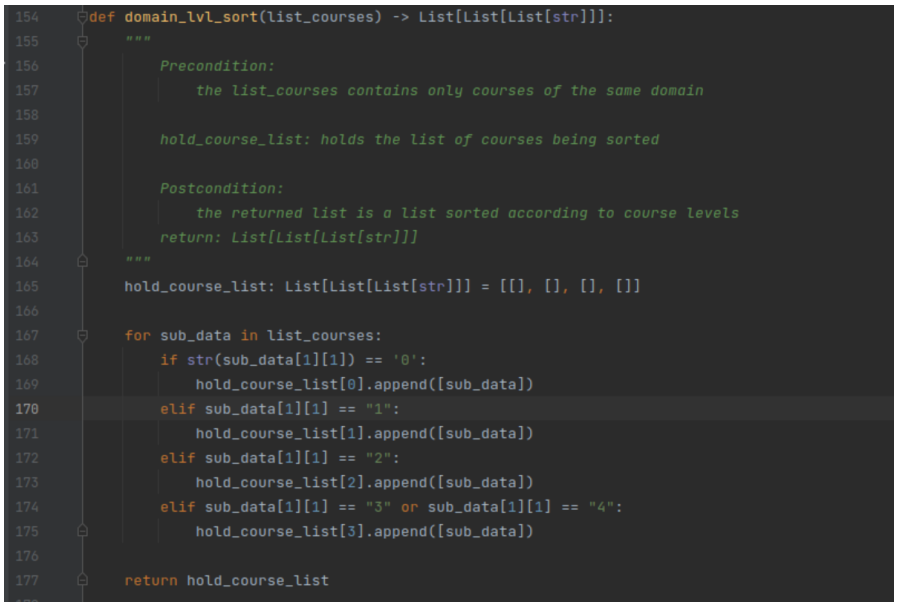
Screenshot of the main GUI function code



```
def gui() -> None:
    """
    Pre-condition:
        tkinter is properly imported and the window is made

    my_font: font - Varela
    my_header: label
    submit_button: button

    Post-conditions:
        The window screen is properly made and displays all the labels and checkboxes
    return: None
    """
    global window
    window.configure(bg='#FFC772')  # setting the color of the gui
    window.title("HaverCourse")  # setting the title of the gui
    my_font = font.Font(family='Valera', size=55)  # making a my_font variable to store the font for the gui

    my_header = Label(text="HaverCourse", bg='#FFC772', pady=20)  # creating a header Label
    my_header['font'] = my_font  # setting the font to our selected font
    my_header.pack()  # displays the header label on the screen

    domains()  # call to the domain function which creates the checkboxes for the domains
    levels()  # call to the domain function which creates the checkboxes for the levels

    submit_button = Button(window, text='Submit', bg='#FFAE30', fg='#ffffff', font='Varela',
                           command=create_scroll)
    # creating the submit button
    window.bind("<Return>", lambda event: create_scroll())  # making the enter key do the same as the submit button
    submit_button.pack(side=BOTTOM, anchor="e", padx=10, pady=10)  # places the submit button at the bottom of the gui

    window.mainloop()  # makes the gui stay active while waiting for user actions
```

**Short comment** - The GUI function displays the labels containing the headings – HaverCourse, Domains, and Levels – and the checkboxes under the domains and level labels.

Screenshot of the domain level sorting function



```
def domain_lvl_sort(list_courses) -> List[List[List[str]]]:
    """
        Precondition:
            the list_courses contains only courses of the same domain

        hold_course_list: holds the list of courses being sorted

        Postcondition:
            the returned list is a list sorted according to course levels
        return: List[List[List[str]]]
    """
    hold_course_list: List[List[List[str]]] = [[], [], [], []]

    for sub_data in list_courses:
        if str(sub_data[1][1]) == '0':
            hold_course_list[0].append([sub_data])
        elif sub_data[1][1] == "1":
            hold_course_list[1].append([sub_data])
        elif sub_data[1][1] == "2":
            hold_course_list[2].append([sub_data])
        elif sub_data[1][1] == "3" or sub_data[1][1] == "4":
            hold_course_list[3].append([sub_data])

    return hold_course_list
```

**Short comment -** This function sorts through the domain courses into levels. The new sorted list has four elements, in the level order 000, 100, 200, 300+ level course.

Screenshot of the create_scroll function that combines all the different sub ideas and functions together

```
68      # creating the font of text displayed on the screen
69      my_font_dom = font.Font(family='Varela', size=50)
70      my_font_disp = font.Font(family='Times New Roman', size=30)
71
72      # prints the appropriate info selected by the user
73      for i in range(len(domains)):  # goes over the domains
74          if checked_domain[i]:  # checks if that domain checkbox has been checked
75              # making the title of the course domain i.e. Domain A, Domain B, Domain C
76              title_label = Label(second_frame, text=f"Domain {domains[i]}", anchor=NW, padx=200, pady=20, bg='#FFC772')
77              title_label['font'] = my_font_dom  # setting the font to our font
78              title_label.pack()  # displaying it on the screen
79
80              # goes over the levels
81              for j in range(len(level)):
82                  if checked_level[j]:  # checks if the level has been checked
83                      # goes over the courses in the level of selected domain
84                      for k in range(len(combined_lvl_dom[i][j])):
85                          for info in combined_lvl_dom[i][j][k]:  # goes over each course in the list
86                              for n in range(len(info)):  # goes over the details of each course
87                                  description_label = Label(second_frame, text=f"{description[n]}:"
88                                                                              f"  {remove_nl(info[n])}", padx=10,
89                                                            wraplength=1500, border=10, anchor=NW, bg='#FFC772')
90                                  # setting the font of the displayed info
91                                  description_label['font'] = my_font_disp
92                                  description_label.pack(fill=BOTH, expand=1)
93
94                          # making a blank space for better organization of displayed info
95                          make_space = Label(second_frame, pady=10, bg='#FFC772')
96                          make_space.pack()
97
98      window2.mainloop()
99
```

**Short comment** - This function makes the scrollable GUI page and displays the results. The for loop starting on line 73 goes through the checked domains and checked level lists to determine which options the user had selected. The loops following it find the appropriate data to which is then displayed on the GUI.

Screenshot of test and results


Short comment - The above screenshot shows the user selecting Domain B and 300+ level courses and the program displays the results based on those inputs.

**Discussion**:

Although our project is finished, it is important to note that the process was not perfect as we did face some challenges throughout. Our very first challenge was finding a CSV file of the Haverford courses data (Department, title, attribute, level, etc). We looked online but could not find one so we decided to reach out to the registrar's office to ask for a copy. After a few emails and in-person visits, we could finally have it and officially get started. The next challenge was to teach ourselves GUI, Graphical User Interface, in a short period of time and luckily we found abundant resources on the Internet to accomplish this. As we started building the GUI, we had more unpredicted problems that deepened our knowledge about how GUI works. GUI was more complex than we imagined; every time we thought we were done, we had to write a new function to account for a certain feature we overlooked or thought was automatically included. For instance, some of the features we needed to add included making the GUI course result page scrollable and get the resulting courses to be displayed on it. Moreover, we needed to have a

proper positioning for the widgets/labels on the main screen of the project and to figure out the filtering and sorting functions that would generate accurate results to the users. And those functions were not enough, contrary to what we assumed, as we needed extra functions to display the appropriate filtered domain/level courses based on the user's choice. We also needed to figure out how to connect the resulting functions together. All in all, through the challenges we encountered, we realized how precise, demanding, and detailed building a GUI is and we could get a glimpse of what it feels and looks like to be a full stack developer.

**Conclusion**:

As stated above, HaverCourse is a program that generates course recommendations for students at Haverford, based on requirements they need to fill. Although we faced challenges, such as learning how to create a graphical user interface, finding a csv file of all Haverford courses, and creating a display page that scrolled. We overcame them all and persevered through. We used new and old features and libraries in Pycharm, such as *Tkinter*, *typing*, and *csv*, which allowed us to expand our programming knowledge. This project provided us a space to work together and create a program that could actually be used by other students at Haverford. In the future, it could be interesting to add some other features and touch it up in order to allow students at Haverford to actually use it as a course recommendation system.

Code sources -

Learning GUI -

Tkinter Course - Create Graphic User Interfaces in Python Tutorial

Making the scrollable GUI page -

Adding a Full Screen ScrollBar - Python Tkinter GUI Tutorial #96

Binding the mousewheel scroll to scroll the page -
https://stackoverflow.com/questions/17355902/tkinter-binding-mousewheel-to-scrollbar

General key binding -
https://www.tutorialspoint.com/how-to-bind-a-key-to-a-button-in-tkinter

Making the GUI fit to screen -
https://stackoverflow.com/questions/30965033/python-tkinter-application-fit-on-screen