

# Scheduling System User Manual

## Section 1 - Installation Instructions

### 1.1 - Download Excel Template & Python Code

- Download provided files
  - **ScheduleTemplate.xlsm** - Excel template
  - **python-v2.py** - Main Python file
  - **model.py** - Python file containing optimization model logic
- Place files in a single folder

### 1.2 - Download Python (version 3.9+)

#### Windows (64-bit)

- Click link below to download Python Windows Installer (64-bit)
- Open downloaded file (python-3.9.12-amd64.exe) and follow installation guide

<https://www.python.org/ftp/python/3.9.12/python-3.9.12-amd64.exe>

#### Other operating systems

- Find appropriate download for Python version 3.9.12 (or later) at link below

<https://www.python.org/downloads/release/python-3912/>

#### Detail support link

<https://www.python.org/downloads/>

## 1.3 - Download Pip

### Windows

- Open PowerShell, paste the following command and click Enter

```
py -m ensurepip --upgrade
```

### Other operating systems

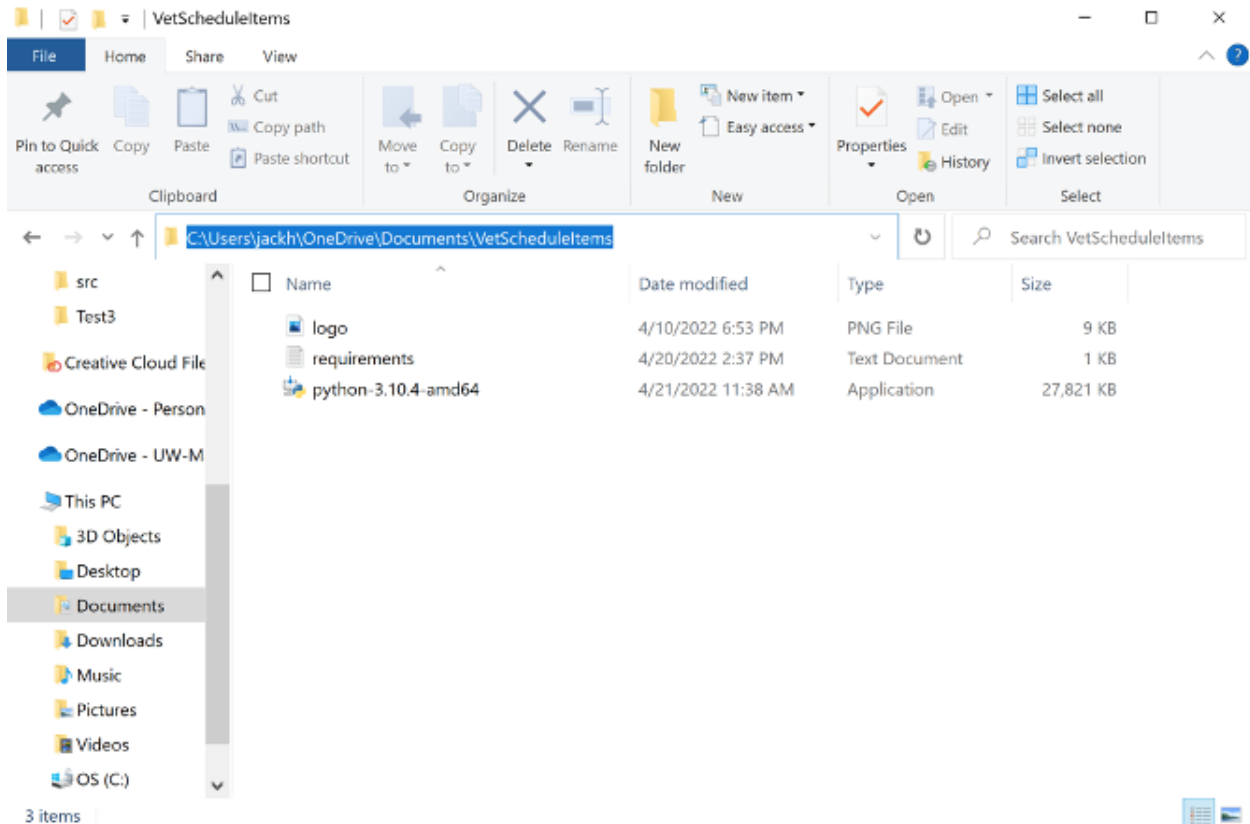
- See detailed support link

### Detailed support link

<https://pip.pypa.io/en/stable/installation/>

## 1.4 - Download Python Packages

- Open File Explorer
- Navigate to folder with files (See 1.1)
- Copy location of folder
  - Example: C:\Users\jackh\OneDrive\Documents\VetScheduleItems



- Open CommandShell, type “cd “, paste the folder path with “”, and click Enter

```
cd "{folder path}"
```

- Then type “pip install -r requirements.txt”, and click enter

```
pip3 install -r requirements.txt
```

## 1.5 - Download & Install Gurobi

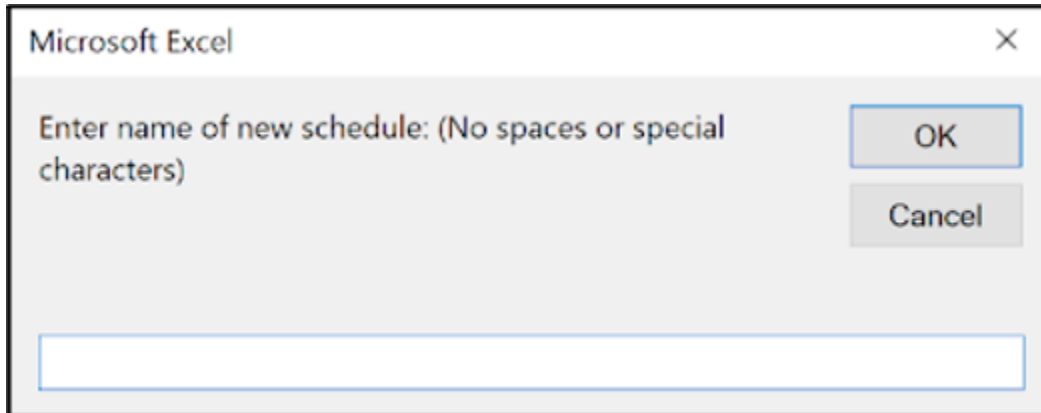
### Detailed Support Link

<https://www.gurobi.com/academia/academic-program-and-licenses/>

# Section 2 - User Guide

## 2.1 - Open ScheduleTemplate.xlsm

- Do not make any changes to this file

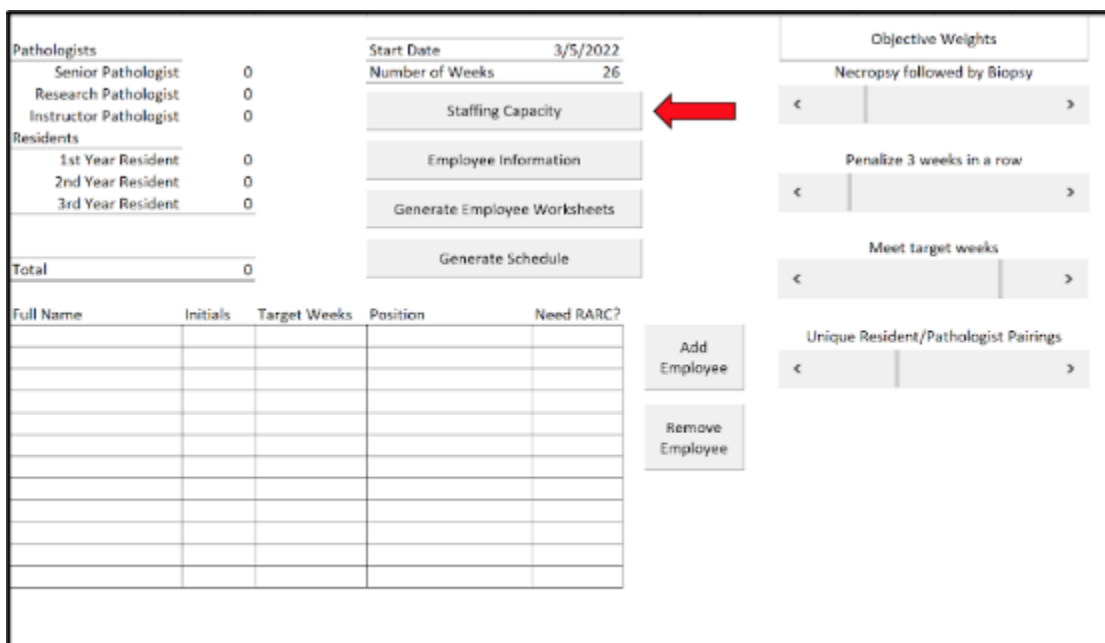


A screenshot of a Microsoft Excel dialog box. The title bar says "Microsoft Excel". The main text reads "Enter name of new schedule: (No spaces or special characters)". Below this is a text input field. To the right of the input field are two buttons: "OK" and "Cancel".

Enter name of new schedule file

- Don't use special characters (\, /, \$, etc.) or spaces
- This will open a new Excel file where the schedule can be developed

## 2.2 - Schedule Information



A screenshot of a software interface for scheduling. It features several sections:

- Pathologists:** A table with columns for position, count, and start date. The start date is 3/5/2022. The number of weeks is 26.
- Residents:** A table with columns for position, count, and start date. The start date is 3/5/2022. The number of weeks is 26.
- Staffing Capacity:** A button with a red arrow pointing to it.
- Employee Information:** A button.
- Generate Employee Worksheets:** A button.
- Generate Schedule:** A button.
- Objective Weights:** A section with several sliders and buttons: "Necropsy followed by Biopsy", "Penalize 3 weeks in a row", "Meet target weeks", and "Unique Resident/Pathologist Pairings".
- Table:** A table with columns: Full Name, Initials, Target Weeks, Position, and Need RARC?.
- Buttons:** "Add Employee" and "Remove Employee".

- Here is the initial interface that will be seen. A red arrow will point through the first couple steps

Click the “Staffing Capacity” button

- It will open a form that asks about information for this schedule iteration
- Fill out
  - Schedule Start Date
  - Duration of schedule (in weeks)
  - Number of each type of employee
- This can all be edited later

Enter Staffing Information	
Schedule Start Date	Pathologists
<input type="text" value="3/5/2022"/>	Senior <input type="text" value="1"/>
Number of Weeks	Regular <input type="text" value="1"/>
<input type="text" value="26"/>	Instructor <input type="text" value="1"/>
	Residents
	1st Year <input type="text" value="1"/>
	2nd Year <input type="text" value="1"/>
	3rd Year <input type="text" value="1"/>
<input type="button" value="Ok"/> <input type="button" value="Clear"/> <input type="button" value="Cancel"/>	

This automatically opens the “Employee Information” form

- Enter employee information
  - Initials
    - Ensure no initials are the same
  - Full name
  - Check the target number of weeks

- Change if necessary
- Select if RARC is required

PracticeForm

Employee Initials	Full Name	Position	Target Weeks	Need RARC?
		Senior Pathologist	14.3	No
		Research Pathologist	2.6	No
		Instructor Pathologist	11.7	No
		1st Year Resident	11.7	No
		2nd Year Resident	13	No
		3rd Year Resident	14.3	No

Ok Clear Cancel

This information is populated on the input sheet

Pathologists		Start Date	3/5/2022
Senior Pathologist	1	Number of Weeks	26
Research Pathologist	1		
Instructor Pathologist	1		
Residents			
1st Year Resident	1		
2nd Year Resident	1		
3rd Year Resident	1		
Total	6		

Full Name	Initials	Target Weeks	Position	Need RARC?
John Ross	JKR	14.3	Senior Pathologist	No
Becky White	BKW	2.6	Research Pathologist	No
Harold Bennett	HWB	11.7	Instructor Pathologist	No
Patty Johnson	PLJ	11.7	1st Year Resident	Yes
Mary Walker	MKW	13	2nd Year Resident	Yes
Jack Reynolds	JJR	14.3	3rd Year Resident	No

Staffing Capacity
Employee Information
Generate Employee Worksheets
Generate Schedule

Add Employee
Remove Employee

## 2.3 - Data Entry

If the information is accurate, click the “Generate Employee Worksheets” button

- The Final Schedule overview sheet should open

Start Date	3/5/2022	Generate Schedule		Generate Schedule PDF		Clear Schedule Output	
Number of Weeks	26						
		JKR	BKW	HWB	PLJ	MKW	JJR
3/5/2022	3/11/2022						
3/12/2022	3/18/2022						
3/19/2022	3/25/2022						
3/26/2022	4/1/2022						
4/2/2022	4/8/2022						
4/9/2022	4/15/2022						
4/16/2022	4/22/2022						
4/23/2022	4/29/2022						
4/30/2022	5/6/2022						
5/7/2022	5/13/2022						
5/14/2022	5/20/2022						
5/21/2022	5/27/2022						
5/28/2022	6/3/2022						
6/4/2022	6/10/2022						
6/11/2022	6/17/2022						
6/18/2022	6/24/2022						
6/25/2022	7/1/2022						
7/2/2022	7/8/2022						
7/9/2022	7/15/2022						
7/16/2022	7/22/2022						
7/23/2022	7/29/2022						
7/30/2022	8/5/2022						
		JKR	BKW	HWB	PLJ	MKW	JJR

- There is a drop-down box in each cell that can be used to select the employee's duty for that week

Necropsy	
Biopsy	
Teaching	
Time Off	
RARC	
Boards	
Other	

Click an employee's tab at the bottom of the screen to enter information about one person at a time

Employee:	Becky White	Position:	Research Pathologist	Week Target:	2.6					
Start Date	3/5/2022									
Number of Weeks	26									
		Necropsy	Biopsy	Teaching	Time Off	RARC	Boards	Other		
3/5/2022	3/11/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
3/12/2022	3/18/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
3/19/2022	3/25/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
3/26/2022	4/1/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4/2/2022	4/8/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4/9/2022	4/15/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4/16/2022	4/22/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4/23/2022	4/29/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4/30/2022	5/6/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5/7/2022	5/13/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5/14/2022	5/20/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5/21/2022	5/27/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5/28/2022	6/3/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
6/4/2022	6/10/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
6/11/2022	6/17/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
6/18/2022	6/24/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
6/25/2022	7/1/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
7/2/2022	7/8/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
7/9/2022	7/15/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
7/16/2022	7/22/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
7/23/2022	7/29/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
7/30/2022	8/5/2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
>	Hidden	User Input	FinalSchedule	JKR	BKW	HWB	PLJ	MKW	JJR	(+)

- The checkbox assigns the employee to that responsibility
- Any information entered here is linked back to the final schedule



Start Date	5/3/2022		Generate Schedule		Generate Schedule PDF		Clear Schedule Output			
Number of Weeks	26									
Status	Schedule Found!									
	JKR	BKW	HWB	PLI	MKW	JJR				
5/3/2022	5/9/2022									
5/10/2022	5/16/2022									
5/17/2022	5/23/2022	Time Off								
5/24/2022	5/30/2022									
5/31/2022	6/6/2022									
6/7/2022	6/13/2022		Teaching							
6/14/2022	6/20/2022									
6/21/2022	6/27/2022			Necropsy						
6/28/2022	7/4/2022									
7/5/2022	7/11/2022									
7/12/2022	7/18/2022	Time Off								
7/19/2022	7/25/2022	Time Off								
7/26/2022	8/1/2022									
8/2/2022	8/8/2022									
8/9/2022	8/15/2022									
8/16/2022	8/22/2022									
8/23/2022	8/29/2022									
8/30/2022	9/5/2022									
9/6/2022	9/12/2022									
9/13/2022	9/19/2022									
9/20/2022	9/26/2022									
9/27/2022	10/3/2022									
Hidden		User Input	FinalSchedule	JKR	BKW	HWB	PLI	MKW	JJR	(+)

## 2.4 - Run Optimization Model

When the information is all entered, click the “Generate Schedule” button

- This will run the optimization model
- It may take a few seconds to run
- Updates on the status of the model are shown at the top of the screen

Start Date	5/3/2022
Number of Weeks	26
Status	Infeasible

## 2.5 - Final Schedule Output

Here is an example of what the final schedule output could look like

- Color coded by responsibility
  - Blue: Staffed on Biopsy or Necropsy
  - Grey: Unavailable
  - White: Available

Start Date		3/5/2022	Generate Schedule	Generate Schedule PDF	Clear Schedule Output		
Number of Weeks		26					
		JKR	BKW	HWB	PLJ	MKW	JJR
3/5/2022	3/11/2022	Necropsy	Biopsy		Biopsy	Necropsy	
3/12/2022	3/18/2022	Biopsy	Teaching	Necropsy		Biopsy	Necropsy
3/19/2022	3/25/2022	Necropsy	Teaching	Biopsy	Necropsy		Biopsy
3/26/2022	4/1/2022	Biopsy	Teaching	Necropsy	Biopsy	Necropsy	
4/2/2022	4/8/2022	Biopsy	Necropsy			Biopsy	Necropsy
4/9/2022	4/15/2022	Time Off	Biopsy	Necropsy	Necropsy		Biopsy
4/16/2022	4/22/2022	Necropsy		Biopsy	Biopsy	Necropsy	
4/23/2022	4/29/2022	Biopsy	Necropsy			Biopsy	Necropsy
4/30/2022	5/6/2022		Biopsy	Necropsy	Necropsy		Biopsy
5/7/2022	5/13/2022	Necropsy	Boards	Biopsy	Biopsy	Necropsy	
5/14/2022	5/20/2022	Teaching	Necropsy	Biopsy		Biopsy	Necropsy
5/21/2022	5/27/2022	Necropsy	Biopsy		Necropsy		Biopsy
5/28/2022	6/3/2022	Biopsy	Time Off	Necropsy	Biopsy	Necropsy	
6/4/2022	6/10/2022	Necropsy	Time Off	Biopsy		Biopsy	Necropsy
6/11/2022	6/17/2022	Biopsy	Necropsy		Necropsy		Biopsy
6/18/2022	6/24/2022		Biopsy	Necropsy	Biopsy	Necropsy	
6/25/2022	7/1/2022	Necropsy		Biopsy		Biopsy	Necropsy
7/2/2022	7/8/2022	Biopsy	Necropsy		Necropsy		Biopsy
7/9/2022	7/15/2022		Biopsy	Necropsy	Biopsy	Necropsy	
7/16/2022	7/22/2022	Necropsy		Biopsy		Biopsy	Necropsy
7/23/2022	7/29/2022	Biopsy	Necropsy		Necropsy		Biopsy
7/30/2022	8/5/2022		Biopsy	Necropsy	Biopsy	Necropsy	

- If unhappy with schedule, click clear schedule output button or select a range of cells to delete

## 2.6 - Objective Weights

The prioritization of different aspects of the schedule can be adjusted using these sliders

- Moving them to the right prioritizes them more

Objective Weights

Necropsy followed by Biopsy

< | >

Penalize 3 weeks in a row

< | >

Meet target weeks

< | >

Unique Resident/Pathologist Pairings

< | >

## 2.7 - What-If Scenarios

To see how adding employees can affect the final schedule, use the add/remove employee buttons

Pathologists		Start Date	5/3/2022
Senior Pathologist	1	Number of Weeks	26
Research Pathologist	1	Staffing Capacity	
Instructor Pathologist	1		
Residents		Employee Information	
1st Year Resident	1	Generate Employee Worksheets	
2nd Year Resident	1		
3rd Year Resident	1	Generate Schedule	
Total	6		

Full Name	Initials	Target Weeks	Position	Need RARC?
aaaaaaa	JKR	14.3	Senior Pathologist	No
bbbbbbb	BKW	2.6	Research Pathologist	No
ccccccc	HWB	11.7	Instructor Pathologist	No
ddddddd	PLI	11.7	1st Year Resident	No
eeeeeee	MKW	13	2nd Year Resident	No
fffffff	JJR	14.3	3rd Year Resident	No

Add Employee  
Remove Employee

Objective Weights

Necropsy followed by Biopsy

< | >

Penalize 3 weeks in a row

< | >

Meet target weeks

< | >

Unique Resident/Pathologist Pairings

< | >

- This will generate/remove worksheet tabs and columns in the Final Schedule overview

## **2.8 - Generate Schedule PDF**

When changes are made, click “Generate Schedule” button to re-run the model

- When happy with output, hit the “Generate Schedule PDF” button at the top of the screen to create a pdf of the final schedule
  - Saved in the same directory as the Excel file