

Developer Information

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Design Overview

The basic idea behind the design of the tax tools is that every tax form has the same basic design. All tax forms are series of lines, where each line is a step in the calculation of one or a few tax values. Each line consists of a line number, a description, and a value. The description tells how to calculate the value for that line.

The calculation for any individual line consists of simple operations, such as:

- Reading a value from another line.
- Reading a value from another form.
- Enter a constant value such as a percentage and dollar amount.
- Performing arithmetic using values determined earlier in the form
- Comparing values to skip steps

Each step calculates the next intermediate value until the last line where the final result is determined. The steps are calculated in order from the first to the last. The a step may use values from previous steps or get values from other forms.

If a line requires a more complicated calculation, that calculation is relegated to another tax form or a worksheet, and the current form simply says to get the value from that form. Worksheets are implemented using the same simple design, that is, a series of lines that perform individual steps in a larger calculation.

This design is also highly flexible and extensible. There are probably hundreds of tax forms, but only the tax forms that you intend to use need to be implemented. If a tax form references a value in another form that has not been implemented, it gets a value of 0. If at some point in the future that form is implemented, its value will automatically start to be used.

The calculation is automatic in another way as well. A form will not be calculated until the first time it referenced. Thus, a form will only be calculated if it is referenced by another form and dependencies will be sorted out naturally. The only time this is a problem, is if there are forms that either directly or indirectly reference each other, and the only instance of this that I have found is with form 1040. Form 1040 references many other forms and other forms reference information on form 1040 (such as AGI). However, as long as form 1040 is calculated first, the information on form 1040 that is referenced by another form will be calculated by the time it is referenced by any other form.

Tax Tools

The simple and consistent design of tax forms allows all tax forms to be implemented in a similar manner. Only the implementation of the individual steps needs to change from one tax form to the next, and this applies to worksheets as well.

Most of the tax tools are based on the idea of providing the result from a small section of the overall income tax calculation. This, in turn, can be accomplished by performing the calculation from one or a few tax forms. For example, to determine how much of the taxpayer's Social Security benefit is taxable, you would create tool that returns the result from calculating the Social Security Benefits Worksheet (see 1040 Instructions, lines 6a and 6b). Here are the steps for such a tool.

1. Look at the worksheet to see what information is used in the calculation (that is, find all the lines that reference a value in another tax form).
2. Provide a user interface to get that information from the taxpayer.
3. Create skeleton tax forms that contain only the information provided by the taxpayer.
4. Get the value from the final step in the Social Security Benefits Worksheet. Accessing this value, will trigger the calculation of the worksheet. The steps in the worksheet will access the values in the skeleton tax forms and calculate the result.
5. Display the result from the worksheet to the taxpayer.

A variety of tools can be created that provide tax calculations based on a small set of values provided by the taxpayer. By letting the taxpayer manipulate the information used in the calculation, very useful tools can be created for analyzing various tax situations.

Tax Forms

As I said earlier, the layout of each tax form is similar, and therefore, their implementation in software can be similar. Each tax form is implemented as a Class that is extended from the Form parent class.

Form Class

The Form class defines the basic structure of the tax form (properties and methods). The Form class is implemented in the file `Library/Classes/TaxForm.js`.

name Property

The name of the form and the class name of the form implementation are usually the same. By convention, a class name is capitalized using camel case (first letter of each word is capitalized, no space or character between words) and it must begin with a letter, so for example, "F1040" is the name of Form 1040. This property facilitates referring to the form by name, rather than class. By convention, a variable that contains a reference to a tax form object uses the tax form name in snake case (all lower case with words separated by underscores), for example "f1040".

lines Property

The lines property is an object that contains one element for each line on the tax form. This object is indexed by line number (which is not necessarily a number; for example, "01a") and the corresponding value is a line object. The line object contains all the information about the line such as its value, a description, and minimum and maximum values. Line numbers correspond to the line number of the actual tax form, except line numbers from 1-9 are prepended with a zero (0) so they will easily sort in the correct order.

calculated Property

The calculated property indicates whether or not the form has been calculated (that is the steps have been performed). Once a form has been calculated, it does not need to be recalculated.

isSingleton Property

The isSingleton flag is just used for error checking to prevent multiple instances of some forms from being created.

add() Method

A variable list of line numbers can be passed to the function. The values in those lines in the current form will be added together and returned.

isUsed() Method

This method determines if any input information was provided to this tax form. If not, the form was created by a reference from another form, but it was not used, and therefore, does not need to be part of the output. This method in the Form class is very generic and may need to be overridden by the child class.

line() Method

This method returns the value of the specified line from the current tax form.

min() Method

This method gets the values of the specified lines from the current tax form and passes the values to the `Math.min()` function, and returns the result.

max()Method

This method gets the values of the specified lines from the current tax form and passes the values to the `Math.max()` function, and returns the result.

round() Method

This method gets the value of the specified line from the current tax form and passes it to the `Math.round()` function, and returns the result.

subtract() Method

This method gets the values of the two specified lines from the current tax form, subtracts the second value from the first, and returns the result.

Tax Form Classes

Each tax form is implemented as a separate JavaScript class. By convention, a class name is capitalized using camel case (first letter of each word is capitalized, no space or character between words) and it must begin with a letter, so for example, "F1040" is the name of Form 1040. By convention, a variable that contain a reference to a tax form object uses the tax form name in snake case (all lower case with words separated by underscores), for example "f1040".

Tax forms are saved in the directory `Library/TaxForms`, so for example, the implementation of the class for the 1040 tax form would be in `Library/TaxForms/F1040.js`.

As mentioned above, each tax for is implemented as a subclass for the Form class. The Form class defined the attributes and several common methods, but there are several methods that are unuque to each tax form and need to be implemented for each tax form.

constructor() Method

The Form parent class defined an empty object of for the lines of the tax form. The constructor for each tax forms needs to provide the prototype for each line in the tax form and add a description for each line. The description is used by the `toString()` method and is useful for providing debugging messages.

calculate() Method

This is the method that is called to calculate the tax form (that is, execute the steps). Typically, this method is only called if another form wants a value from a line in this tax form. Once this method is called, it will return immediately if it is called again. However, if the input values are changed, all the tax forms will be recalculated if they are referenced again.

getInputHTML() and getOutputHTML() Methods

Currently, Tax Return Calculator is the only tax tool that uses tax forms for its input and output interfaces. However, since it uses them, HTML code has been developed to display the tax forms on web pages for each of the tax forms that are supported. The HTML code is stored in a variable named HTML_FORM in the class for each tax form. The methods getInputHTML() and getOutputHTML() are used to return a string containing this code.

There are a few reasons that two separate methods are needed.

- In the tax tools, input fields are always green and output fields are always blue, thus, depending upon how a tax form is being used, it may use a different color scheme.

- The user needs to be able to enter information in the fields of a tax form used for input, but that should not be the case for tax forms used to display information. The user should not be able to enter information in a tax form used for output.

- The method getInputHTML() is a static method because when the input page is created there is not instance of the form yet. Conversely, when a tax form is created to output data, the information in the instance of the tax form needs to be copied to the tax form, thus, the getOutputHTML() method is an instance method.

To make this work, the HTML code for each tax form needs to adhere to some conventions.

- All of the fields on the form will contain their initial values. Typically this is zero or blank, possibly with a placeholder value (a grayed out value, with a demonstration value).

- The value field for each line of the tax form will have an ID assigned to it. The ID will be the form name, a unique identifier, and the line number separated by hyphens (for example, f1040-1-1a). The identifier will use only lowercase letters.

- The CSS file Library/CSS/TaxForms.css provides a set of classes that can be used to provide consistent appearance across all forms.

- The entire form will be enclosed in an HTML details element. This element will have an ID of the form name, the same unique identifier used above, and the word “details” separated by hyphens (for example, f1040-1-details). The identifier will use only lowercase letters.

static getUserInput() Method

This is a static method. For each line on the tax form, this method will read the value of the line from the web page. As mentioned above, the tax form line number corresponding to each field is embedded in the ID assigned to that field. This method only needs to be implemented for tax forms that provide input data, such as income forms (e.g., W-2, 1099s).

put1040Information() Method

This is a static method. For each line on the tax form, this method will insert the value from the line on the tax form into the corresponding field in the web page. As mentioned above, the tax form line number corresponding to each field is embedded in the ID assigned to that field. This method only needs to be implemented for tax forms that are part of the tax returns (i.e., output forms such as form 1040 and Schedule A).

Worksheets

Worksheets are associated with an immediate need for calculation, and their calculation may be specific to the form that needs the calculation. For example, there may be multiple schedule C's and each one needs one needs its own calculation of the self-employment tax and SEHI deduction. Therefore, worksheets should be created by the form that needs the calculation. If you were to access the worksheet via `Forms.getValue()`, it could return a value from a worksheet created for another form.

Therefore, worksheet constructors should call the `calculator()` method directly, and the worksheet can then be accessed as follows:

```
const value = Forms.createForm("Worksheet").line("lineno");
```

Or,

```
const form = Forms.createForm("Worksheet");  
const value = form.line("lineno");
```

Tax Form Pages

Tax forms exist in two forms: classes (objects) and web pages (HTML). As said above, each tax form is implemented as a class and stored in the directory `Library/TaxForms`. Instances of the tax form classes are the internal representation of the tax forms. The class `TaxForms` (with an "s" at the end) is a separate class that manages the instances of the tax forms that have been created.

While tax form classes and their objects are the internal representation of tax forms, tax form web pages are the external representation of the web pages. They provide the place to input data and they display the completed tax return. Most of the tax tools do not use the tax form web pages because they provide a simplified view of the information on the tax forms. However, each tax form object has the ability to display itself as a web page. This makes each tax form the centralized location for all the information about that tax form.

The class `TaxFormPages` provides utilities for creating, deleting, and managing the tax form web pages. Currently, this class and the tax form web pages are only used by the Tax Return Calculator tool. It uses these pages because it more closely resembles a tax program using actual tax forms. Most tax forms fall into one of two categories.

1. Tax forms that provide information that is used to calculate the tax return. These tax forms are in the category of input tax forms.
2. Tax forms that are part of the tax return are output tax forms. They are produced as a result of the tax calculation.

In most tax tools, information that is provided to the tool for its calculation can be entered into any form, whether it is an input form or an output form. However, care must be taken when entering information into an output form. Any information that is provided by the user and entered into a tax form will not be changed when that tax form is calculated. For example, if a tool asks the taxpayer to enter the adjusted gross income (AGI) and that information is entered into form 1040, then the AGI value will not be changed when the tax information is calculated regardless of what other income information is available to the tax tool.

In the case of input tax forms, this is not an issue, but in the case of output tax forms, this implementation allows the taxpayer to override any field in any tax forms. If the user does not want the value to be overridden, they can simply not enter the information and the tax form will calculate the value based on the other information that is available.

Utility Modules

For such a simple idea, there is a lot of code, so this section describes some of the other shared code. All of the shared code stored in the directory `Library` and most of it is in the subdirectory `Classes`. There

are a few code modules that use more than one file and they are stored in their own subdirectory under `Library`.

The `TaxForm`, `TaxForms`, and `Line` classes are the classes used to represent tax forms internally in the tax tools. This has been described earlier.

The `Alert` module is no longer used, but was needed to provide a solution to a timing problem.

The `Debug` module provides a variety of information about the inner workings of the tax tools and a means to control that information.

The modules `Dates`, `Num`, `Str`, and `Objects` provide functions that implement abstractions for the underlying utility modules.

The `File` module provides the common code used to save and restore the state of a tax tool. This is only used by a few of the tax tools.

Similarly, the `HTML` and `HTMLBuild` modules provide abstractions for working with HTML elements. The `HTML` module provides general utilities for working with HTML elements, while the `HTMLBuild` module provides methods for dynamically creating and adding content to the current web page. The primary abstraction of note is that HTML elements that are used to get information from the taxpayer or show information to the taxpayer are accessed via the “ID” attribute. Thus, every HTML element used for input or output is assigned a unique and descriptive name (i.e., ID). The names only need to be unique within each tool, so whenever possible, the same name is used for the same information across all tools.

The `IncludeFile` module implements an HTML syntax that allows HTML files to include other HTML files. This is not used much anymore. Most HTML files have been changed to PHP files in order to use the PHP include mechanism instead.

The `TaxTable_20xx` modules contain the definition of constant values and tables of data that are needed in tax calculations. These values change from year to year; therefore, there is a separate module for every year that is supported. The `TaxTableTmpl` class is a separate module that implements the methods for accessing the tax table information. Each of the `TaxTable_20xx` modules is a child class of the `TaxTableTmpl` module so these methods provide a common set of access methods for the information in the tax tables, regardless of the tax year. The module `TaxTable` provides the static method named `getTaxTable`, returns a reference to the correct tax table object based on the year of the return. Since this method is a static method, it can be called from anywhere, essentially making the tax tables global data.

The `TaxPayer` class saves the attributes of the taxpayer. Currently, only one `TaxPayer` object is supported, so it also contains information about the spouse and dependents. Together, the tax payer information, the input tax forms, and the tax tables, and you have all the information you need to complete the tax return.

The directory `SalesTax` is a separate subdirectory of `Library`. Sales tax information is accessed from an external web site, and this directory contains the software that provides access to that site.

The directory `Tooltips` is a separate subdirectory of `Library`. It contains the code to provide popup tooltips when the mouse moves over an HTML element.

The directory `TAXTools` is a separate subdirectory of `Library`. It contains several files that contain things that are intended to be used by all tax tools. For example `TAXTools.css` provides the CSS formatting definitions that give all the tools a common appearance.

Tax Tools

Age Calculator

The age calculator waits for one of the inputs to change. Depending upon which value changes, it uses that value and one of the other values to calculate the third value. Several tax calculations need to know a person's age at the end of the tax year, so in addition to this tool, several of the tools use this calculation internally. That makes this tool useful for testing that code.

Simple Math Calculator

This is a simple four-function mathematical calculator. Calculations on tax forms do not require more advanced mathematical functions so this can be a useful aide when working with tax forms. Also, the input fields in all the tax tools allow you to enter an arithmetic expression in place of a numeric value, and the same expression evaluator is used in both cases. That makes this calculator useful for testing the expression evaluator.

Tax Return Calculator

The Tax Return Calculator tool is unlike the other tax tools. Rather than providing a simplified abstraction for part of the tax calculation, the Tax Return Calculator uses actual tax forms for the input information and the result is similar to an actual tax return.

Other Tax Tools

The remainder of the tax tools (those not described above) are all variations on a theme:

- Each tool provides a web page where you enter information. It only asks for the information it needs to perform the calculation the tool is designed to perform.

- It maps the input information to fields on actual tax forms and creates digital tax forms internally.

- It performs the calculation implemented by each of the tax forms.

- It gets the information it needs from the appropriate tax form and writes the result of the calculation to the web page for the user to see.

The tax tools that use this basic design are:

- Alternative Minimum Tax Calculator

- California Sales Tax Calculator

- California Sales Tax Deduction Calculator

- Federal Estimated Tax Calculator

- California Estimated Tax Calculator

- Required Minimum Distribution Calculator

- Senior Deduction Calculator

- Small Business Tax Calculator

- State Income Tax Refund Calculator - Since the amount of income tax paid to the state is deductible on the federal tax return, a state tax refund may be taxable as income on the following year's federal tax return. The calculation to determine how much of the refund is taxable is described in the instructions for form 1040. See the section for Schedule 1, Additional Income, Line 1, State and Local Income Tax Refund Worksheet.

- Taxable Social Security Benefit Calculator – The amount of the taxpayer's Social Security benefit that is taxable is a common question and it is difficult to predict beyond 0-85%. This tool performs the calculation based on the information provided by the user. Since the user will not know the exact

values needed for the calculation, this tool can only provide an estimate. The worksheet to perform the calculation is described in the instructions for form 1040 in the instructions for entering lines 6a and 6b.

Lump Sum Social Security Tax Calculator

Conventions

Coding Conventions

- Indentation in HTML, CSS and JavaScript files is 1 tab and tabs are 4 spaces. UNIX style newlines are used between lines, not Windows style carriage return- newline combinations.
- Use `===` and `!==`, not `==` and `!=` whenever possible.
- Do not use `var`.

Naming Conventions

A variety of naming conventions are used to create symbolic names beyond the rules implied by the languages. When the name used all lowercase letters and underscores are used to separate words or parts, that is called “snake case”. “Kebab case” is similar except it uses hyphens to separate words. “Camel case” is when there is no separation between words, but each word is capitalized. The following list show the naming conventions used in the tax tools source code.

Variable names	Snake case
Procedure and method names	Camel case, 1 st letter is lowercase
Class names	Camel case, 1 st letter is uppercase
CSS class names	Kebab case
HTML element IDs	Kebab case

Design Notes

- To make web page print-friendly, you can add the following line to your stylesheet. This rule automatically strips extra padding and background colors when the user presses Ctrl+P / Cmd+P to save it as a crisp PDF.

```
Or,
@media print { body { padding: 0; background: none; } }
@media print {
  body { background: none; padding: 0; }
  .form-1040 { border: none; width: 100%; }
}
```

The Forms.js module manages the forms that are in use by the tool. Any form that is created should be created by calling `Forms.createForm()`, not by calling `new FormName()`. This allows the Forms module to keep track of which forms have been created and providing convenient access to the form information.

Normally, a tax form must be created and calculated before values can be read from the form for use by another form. But to prevent creating and printing a lot of unused forms, if the form is just going to return 0. For example, form 1040 need to read the withholding information from lots of forms (e.g., W-2s, 1099s), it is not necessary to create these forms just to return 0. Any form that does not reference another form and has not already been created with initial values, does not need to be created when it is referenced.

A form does not need to be created to be accessed. If the form does not exist, the value returned will be 0. This is sufficient for any form that does not access another form such as the W-2 or 1099-INT. If a form

does exist, its `calculate()` method must be called to make sure the data is correct (the modified flag can be used to prevent recalculating a form when it is not necessary).

A form can be accessed by `Forms.getValue("formname", "lineno")`. This will create the form if it does not exist, and it will calculate it if it has not been calculated. This is how most forms are accessed, and it automatically creates a dependency chain. If a form needs a value from another form, that form will be created and calculated before the value is returned.

Designing Forms

- Look at the original form to decide the increments to divide the form into. If some boxes take up $\frac{1}{2}$ the form and others take up $\frac{1}{3}$ you will need to divide the form into sixths to create the forms. Then all boxes can be multiples of the increment amount.
- When designing a form in HTML, use a grid layout and make the big boxes first, then put smaller layouts inside the boxes.

Source Control

The project name, the repository name, and the folder name that contain the source code for the Tax Analysis Tools is "TAXTools". Therefore, you will frequently see the name "TAXTools" used to refer to the Tax Analysis Tools in this document.

Source code version control for TAXTools is implemented using Git and GitHub. Git is a distributed version control system originally developed for the Linux kernel, but can be use for any project where versioning changes to files is necessary. It is particularly useful in situations where there are multiple people making changes in separate locations. For more information on Git, go to their web page at git-scm.com.

While Git is designed to be a distributed source control system, it is very common to have a central repository that all the developers draw from. GitHub fills this need. It provides a common reference copy of the source code that is always available on the web and always backed up. GitHub provides both free and fee-based hosting for Git repositories. For more information on GitHub, go to their web page at github.com.

Repositories

A repository is a directory that contains the source code for the project and has been initialized for use with Git. When the directory is initialized, Git creates a subdirectory named `".git"` at the top of the source directory. This is where Git stores all the information it needs to track the changes to the source code.

Since Git is a distributed source management system, a project can have any number of repositories. Typically, each developer has a copy on their system. In addition, there may be one repository that is considered the "main" repository where changes are collected and other repositories can be synchronized to keep up with the changes that have been made by others.

This is the case for the Tax Analysis Tools. The main repository is hosted on GitHub at github.com/bb3413/TAXTools.git, and each developer has a local copy of the repository. To work on the Tax Analysis Tools, you start by cloning the repository on GitHub, which creates a local copy that you can use to do your work. By keeping this local copy synchronized with the main repository stored in GitHub, you're able to get the latest changes from the main repository and push your updates back to the main repository so others can use them. To "clone" of the official repository, use the following command.

```
$ git clone https://github.com/bb3413/TAXTools.git
```

Authentication

When working with remote systems, it may be necessary to provide some form of authentication. The Tax Analysis Tools repository is a public repository, so you can read from the repository (for example, clone) without providing any authentication, but to write to the repository, you will need to be authenticated in one of two ways.

1. You can access the Tax Analysis Tools repository using the following HTTPS URL.

```
https://github.com/bb3413/TAXTools.git
```

If you use this URL to write to the repository (for example, `git push`), you will have to provide the account name and a security token each time you write to the repository. This may work well when working from Windows, since the Windows Credential Manager will cache this information and supply it on subsequent commands. See the next section for the steps to create a security token.

2. Alternatively, you can use the secure shell (SSH) to access the repository. In this case, you use the following Git address.

```
git@github.com:bb3413/TAXTools.git
```

This may be more convenient when working from the command line (for example, the Bash shell). However, to use this address, you need to setup the SSH connection as follows.

- a. Execute the `ssh-keygen` command and press enter to accept the default for all the questions. This will create a public (`id_ed25519.pub`) and private key (`id_ed25519`) in the directory `$HOME/.ssh`.

```
$ ssh-keygen -t ed25519 -C "comment"
$ cat $HOME/.ssh/id_ed25519.pub # Show the public key
```

- b. Then, you can copy and paste the public key to GitHub. To enter the public key on GitHub, go to Settings->SSH and GPG keys->New SSH key.

The first time you use this address, you will get a warning asking if you trust the remote system, but you will not need to provide any authentication information.

When reading or writing to the repository, you can use either form of address. It only makes a difference in how you are authenticated.

In addition to providing authentication, you need to be added as a “collaborator” on the project by the owner of the repository if you want to make change to the project.

Creating a Token

To create a personal access token on GitHub, follow these steps:

- In a web browser, go to `github.com`.
- Log into account `bb3413`. Use password for account `bb3413`.
- Go to Home->Settings->Account->Developer settings->Personal access tokens.
- Select Tokens (classic)
- Click on Generate new token
- Select Generate new token (classic)
 - Enter the account password.
 - Note: Full CLI access to repositories. Use web for everything else.
 - Expiration: 90 days
 - Click on Generate token

Branches

A branch refers to a separate versions of the same code. The original version continues in one branch and a separate branch is created to keep copies of changes that deviate from the original branch. Creating a branch allows developers to work on changes without affecting each other. When a change is complete, the branches can be merged back together and any conflicts can be resolved.

The Tax Analysis Tools repository contains two branches. The main branch, named “main”, contains the currently released version of the Tax Analysis Tools. Changes to the main branch may be made for small fixes, but generally, the main branch is only changed by periodically merging with the development branch.

The other branch is the development branch. It is named “develop”, and it contains the new features and fixes. Once a change is believed to work, it can be added to the development branch to give it more exposure and verify that it is stable. Merging the development branch with the main branch is based on the need for the changes and the perceived stability of the development branch.

Small changes may be made directly in the development branch, but new features should be developed in their own branch off of the development branch. Developing new features in their own branch allows the changes to be checked in (committed) even if they are not complete. The need to check in incomplete changes prevents the need to have “stashes” for each change that is in progress but not complete (stashes are needed to save files that are not checked-in when you need to change to another branch to work on another problem).

Create the Initial Repository

Initially, the Tax Analysis Tools consisted of a local directory that contained all of the source code for the tools. This section describes the steps that were used to create the main repository on GitHub from the original source code. This is for information only since the Tax Analysis Tools have already been set up to use Git and GitHub to manage the source code.

1. Create a personal access token on GitHub. GitHub requires using a personal access token instead of a password for authentication when using the command line (e.g., `git push` command).
 - In a web browser, go to github.com.
 - Log into account bb3413. Use password for account bb3413.
 - Go to Home->Settings->Account->Developer settings->Personal access tokens.
 - Select Tokens (classic)
 - Click on Generate new token
 - Select Generate new token (classic)
 - Enter the account password.
 - Note: Full CLI access to repositories. Use web for everything else.
 - Expiration: 90 days
 - Click on Generate token
2. Create the new, empty repository on GitHub.
 - In a web browser, go to github.com.
 - Log into account bb3413. Use password for account bb3413.
 - Click on the "+" icon in the top-right corner and select "New repository."
 - Repository Name: TAXTools
 - Description: Tools for estimating income tax.
 - Choose Visibility: Public
 - Add README: Off
 - Add .gitignore: No .gitignore
 - Add license: No license

- Click "Create repository."
3. Convert the source code directory to a Git repository. The `git init` command will convert the current directory into a Git repository where you can use Git commands to track changes to files in the directory. A Git repository has a subdirectory at the top of the source directory named `.git`. This is where Git stores all the information it needs to track changes to the files.

```
$ cd TAXToolsDirectory
$ git init
```

There may be some files in the directory that are not part of the source code for the project (for example, object files generated by a compiler or files containing private information) and, therefore, you want Git to ignore those files. You can specify these files by making an entry for them in the file `.gitignore`, which you put at the top of the repository. The Git ignore file contains information that is needed by all users of the repository so it should be added to the repository just like a source file. Note: it should only identify temporary files; files that are not ready for release should be left in the source tree so they can be shared when someone clones the repository.

```
$ cat <<-EOF >>.gitignore
# DreamWeaver status files
_notes/

# Editor temporary files
~*
*.swp

# Modules loaded with NPM
nodes_modules/

# NPM status files
package.json
package-lock.json

# ESLint configuration file
eslint.config.mjs
EOF
```

4. Add the source code files to the repository. The `git add` command adds all the files in the repository to the staging area. Commit the changes in the staging area to the repository. At this point, the source code directory is a Git repository and changes to the files in the directory will be tracked by Git.

```
$ git add .
$ git commit -m "Initial commit."
```

5. The main branch is named "master" by default. Change it to "main".

```
$ git branch -M main
```

6. Mark the current version of the Tax Analysis Tools in the main branch with the release number.

```
$ git tag VersionNumber # e.g., "v2025.08"
```

7. Connect the local repository to the remote repository. The `git remote add` command allows you to specify a name and URL for a remote repository. The name "origin" is the default name used by Git when the name of the remote repository is not specified.

```
$ git remote add origin git@github.com:bb3413/TAXTools.git
$ git remote add originSSH git@github.com:bb3413/TAXTools.git
$ git remote add originHTML https://github.com/bb3413/TAXTools.git
```

8. Populate the remote repository with the files from the local repository. The `-u` option sets “origin” and “main” as the default remote repository and branch. This allows you to later execute the `git push` and `git pull` commands without having to specify these parameters.

```
$ git push -u origin main
$ git push origin --tags
```

9. Create the development branch.

```
$ git branch develop
$ git switch develop
```

10. Update the version information.

```
$ edit Version.js Version.html
$ git add .
$ git commit -m "Create new development version."
```

11. Push the development branch to GitHub. The `-u` option changes the default branch, set above, to now be the “develop” branch. The origin is still set to the Tax Analysis Tools repository on GitHub.

```
$ git push -u origin develop
```

12. Go back to GitHub, refresh the page, and make sure the repository looks correct.

Using Git with the Tax Analysis Tools

Configuration Settings

Git configuration settings can be set for a user or a repository. User settings apply to the user whenever they are using Git regardless of which repository they are in. Repository settings apply to all users in a specific repository.

The `git config` command allows you to set Git configuration values. If the `--global` option is used, the command sets the value for the user. If the `--global` option is not used, the command sets the value for the current repository.

User configuration settings are stored in the file `$HOME/.gitconfig`, and repository configuration settings are stored in the file `.git/config` at the top of the repository.

User Settings

Before using Git to make changes, you need to set your name and email address in Git. This information is needed to track changes to the files.

```
$ git config --global user.name "First Last"
$ git config --global user.email "Email address"
```

The default name for the initial branch when creating a Git repository is “master”. This term is deemed improper so it is recommended that you change the default to “main” for any new Git repositories.

```
$ git config --global init.defaultBranch main
```

When a Git repository is not stored on a local disk (e.g., cloud storage), you need to tell Git that you trust the directory containing the repository.

```
$ git config --global --add safe.directory \
'/mnt/g/My Drive/Documents/VSCoDe/TAXToolsDev'
```

Create Local Repository

Since the Tax Analysis Tools are available on GitHub, you can make a local copy of the repository (i.e., source code + Git tracking information) by changing directories to where you want to save the repository and execute the following Git command to clone the repository. This will create a subdirectory named "TAXTools" with the most recent version of the source code for the tax tools.

```
$ cd directory
$ git clone https://github.com/bb3413/TAXTools.git
```

Create Account on GitHub

Once you have a local copy of the Tax Analysis Tools repository, you can make changes to the files and perform most of the steps described in this section, but you will not be able push your changes to the remote repository so others can see them until you have a GitHub account and have been added as a "collaborator" on the repository on GitHub.

1. Create a GitHub account
2. Ask the owner of the repository on GitHub to be added as a collaborator. The repository owner will need your GitHub account name. The owner can add your account as a collaborator by going to the repository and selecting Settings->Collaborators->Add people.

Synchronize with Remote Repository

Before you make a change to the Tax Analysis Tools source code, you want to make sure your local repository contains the most up to date version of the source code file. To synchronize your local repository with the files on the remote repository, use the `git pull` command.

```
$ git switch branch          # Make sure you are in the correct branch
$ git pull
```

Get Status

There are several commands to get information about the repository.

```
$ git status          # Information about the working directory.
$ git show            # List the changes to the current branch.
$ git log             # Show the commit history on current branch.
$ git diff            # See what changed in a file.
```

Example

You can use `git status` to see which files in the working directory have changes. This command can be executed from anywhere in the working directory.

```
$ cd $TAXTOOLS
$ git status
```

From the files that are listed, if they are already being tracked by Git, then you can use the `git diff` command to see which lines in the file have changed.

```
$ cd directory
$ git diff filename
```

Once you are satisfied with the changes, you can add them to the staging area and commit the changes to the repository. When specifying "." as the files to add, that only adds the file from the current directory, so change directories back to the top of the working directory to add all the changes that have not been staged.

```
$ cd $TAXTOOLS
$ git add .
$ git commit -m "Description of change."
```

Or, you can do it one step.

```
$ git commit -a -m "Description of change."
```

Sync with GitHub.

```
$ git push
```

Select a Branch

If you have added, deleted, or modified any files but have not committed those changes, they will remain in your source directory even if you change to a different branch??? For this reason, it is important to make sure you there are no changes that have not been committed before you change branches.

```
$ git status          # Check for changes that have not been committed.
```

After you switch to a new branch, it is also good to make sure the branch is up to date with any changes that have been posted to the remote repository.

```
$ git switch branch
$ git pull          # Make sure it is up to date.
```

Below are some other useful commands for use with branches. The functionality of the `git switch` command is duplicated by the `git checkout` command. The `git checkout` command can switch branches, restore files, and check out commits. The `git switch` command is a newer command intended specifically for switching branches.

```
$ git branch          # List all branches
$ git branch branch   # Create new branch; does not switch to it
$ git branch -d branch # Delete branch
$ git branch -r        # List all branches in remote repository
$ git checkout branch  # Switch to branch
$ git checkout -b branch # Create new branch and switch to it
$ git switch branch    # Switch to branch
$ git switch -c branch  # Create new branch and switch to it
```

Create a New Branch

For most changes, you will start at the development branch and create a new branch where you will make your changes. Before you create a new branch, make sure you are in the correct branch.

You can create a new branch and switch to it in two steps.

```
$ git branch branch    # Create new branch
$ git switch branch
```

Or, one step.

```
$ git checkout -b branch # Create new branch and switch to it
```

Set the default location for `git pull`.

```
$ git branch -set-upstream-to=develop branch
```

Set the default behavior for handling merge conflicts when you do a `git pull`.

```
$ git config pull.rebase false
```

Add a New File

To add a new file to the project, you need to create the file, add it to the staging area, and commit the change (i.e., whatever is in the staging area).

1. Before you add a new file, make sure you are in the correct branch and the correct location, then create the file.
2. Add the new file to the staging area.

```
$ git add filename
```

3. Commit the changes in the staging area. This will commit the changes in the staging area (i.e., the new file) to the repository. At this point, the new file has been added to the current branch. At some point, you may want to merge the current branch into the development branch.

```
$ git commit -m "Description of change."
```

Delete a file

The `git rm` command deletes a file from the working directory and adds the change to the staging area, so after executing the `git rm` command, you can commit the change.

```
$ git rm filename
$ git commit -m "description"
```

Change a File

To change file to the project, you need to edit the file, add it to the staging, and commit the change (i.e., whatever is in the staging area).

1. Before you change a file, make sure you are in the correct branch and that the branch is up to date. Then, change the file.
2. Add the file you changed to the staging area.

```
$ git add filename
```

3. Commit the changes in the staging area. This will commit the changes in the staging area (i.e., the modified file) to the repository. At this point, the modified file has been changed in the current branch. At some point, you may want to merge the current branch into the development branch.

```
$ git commit -m "Description of change."
```

Revert a Change

To discard a change to a file in the working directory before it has been staged use the `git restore` command. This restores the file to the state it was in after the last time it was committed.

```
$ git restore filename      # Restore the file
$ git restore .             # Restore all files in the current directory
                           # and subdirectories.
```

Stage a File

Any change to the working directory, such as adding, deleting, or modifying a file, needs to be added to the staging area before the change can be committed. Use the `git add` command to stage a file. If more than one file is changed, you can specify all the names to the `git add` command or you can specify dot (".") instead of the file name to add all files that have been added, deleted, or modified anywhere in the current directory to the staging area.

```
$ git add filename
```

If you stage a file and then make another change to the file, you need to re-stage the file; otherwise, only the first change will be committed, but the second change will remain in the file in the working directory.

Instead of the `git add` command, you could also use the `git stage` command. These commands can be used interchangeably.

Revert a Stage

If you make a change and add it to the staging area, but you have not committed the change, you can remove the file from the staging area with the following command. The file in the working directory is not affected.

```
$ git reset filename      # Unstage a file
$ git reset                # Unstage everything
```

Commit a Change

The `git commit` command will make all the changes in the staging area a permanent change in the repository.

```
$ git commit -m "Description of change."
```

Revert a Commit

```
$ git revert HEAD          # Revert the last commit
```

Push Changes to the Remote Repository

The repository on GitHub is considered the master repository. While Git is capable of distributed source management, it is common for a central repository to be used as a collection point for all changes and for making official releases. For the Tax Analysis Tools, the repository on GitHub is that repository. The “local repository” refers to the copy of the repository that you have on your local system, and the “remote repository” refers to the repository on GitHub.

If you have permission to change the remote repository you can use the `git push` command to push committed changes from the local repository to the remote repository.

```
$ git push
```

Make a Change to Development Branch

1. Create a local repository if necessary.
2. Bring the local repository up to date from the master repository on GitHub.

```
$ cd TAXToolsDirectory
$ git pull
```

3. Create a branch off the development branch for the change.

```
$ git checkout develop      # Switch to the development branch
$ git checkout -b branch    # Create the new branch
```

4. Feature development loop.

 Edit the files. Edit the version number and version log

```
    $ code .                # Run VS Code editor in the current directory.
```

 Commit the changes.

```
    $ git add .             # Add the changes to the staging area.
    $ git diff --staged
    $ git commit -m "Description of change"
```

5. Merge the changes into the development branch

```
$ git checkout develop      # Change back to the development branch
$ git merge branch         # Merge the changes
```

6. Update Version Information. Edit the version files directly in the development branch. Increment version number (third number) and update version log.

```
$ edit version.js version.html
$ commit -a "Update version"
```

7. Update the master repository on GitHub.

```
$ git push
```

8. Update the Web page with the new prototype version. Open DreamWeaver and push the folder with the Tax Analysis Tools to the web.

Make Change to Main Branch

1. Make sure there are no changes files in local repository. The `git status` command shows which files have been added, deleted, or modified in the local repository.

```
$ git status
```

2. Change to the release branch (main).

```
$ git checkout main
$ git pull
```

3. Edit the files directly in the main branch.

```
$ edit files
```

4. Update version information. Increment the version number (second number) and update version log.

```
$ edit version.js version.html
```

5. Commit the changes in the modified files to the repository.

```
$ git commit -a "Description of change."
```

9. Update the master repository on GitHub.

```
$ git push
```

Merge Development Branch into Main Branch

Merging the development branch into the main branch creates a new release of the Tax Analysis Tools. The head of the main branch is always the current release of the Tax Analysis Tools.

1. Make sure there are no edited files in the working directory. The `git status` command shows which files have been added, deleted, or modified in the working directory.

```
$ git status
```

2. Change to the development branch (develop).

```
$ git checkout develop
$ git pull # Make sure the branch is up to date.
```

3. Update Version Information. Set the version number for the next release and make an entry in the log file.

```
$ cd Version
$ edit version.js version.html
$ git commit -a -m "Update version information." # Add and commit
$ cd ..
$ git push
```

4. Change to the release branch (main).

- ```
$ git checkout main
$ git pull # Make sure the branch is up to date.
```
5. Merge the development branch.

```
$ git merge develop
$ git commit -a -m "Update version information."
```
  6. Create a Release Tag.

```
$ git tag VersionNumber # e.g., "v2025.08"
$ git push # Push the commits
$ git push --tags # Push the tags
```
  7. Copy the release files to the release directory for pushing to the web page. The current branch should still be in release branch (main).

```
$ cd $TAXTOOLS/..
$ rm -rf TAXToolsNew
$ TAXToolsDev/tools/UpdateRelease # Copy TAXToolsDev to TAXToolsNew
$ dircmp TAXTools TAXToolsNew # Compare with previous release
```
  8. If everything looks good, make a backup copy and replace the TAXTools directory with TAXToolsNew.

```
$ mv TAXToolsNew TAXTools-VersionNumber
$ tar -cvzf TAXTools-VersionNumber.tgz TAXTools-VersionNumber
$ cp TAXTools-VersionNumber.tgz $ARCHIVE/TAXTools
$ rm -rf TAXTools # Remove old release files
$ mv TAXTools-VersionNumber TAXTools # Replace with new files
```
  9. Update the web with the new version of the Tax Analysis Tools.

```
$ Open DreamWeaver
Copy the new Tax Analysis Tools to the web
```
  10. Change the local repository back to the development branch.

```
$ cd $TAXTOOLS
$ git checkout develop
$ git pull # Make sure it is up to date.
```
  11. Update Version information for the current development release.

```
$ edit version.js version.html
$ git commit -a "Start new development version."
$ git push
```

## Get a Past Version of TAXTools

### Create a Tag

You create a tag with the `git tag` command. When you push commits to the remote repository, it does not push the tags; they must be pushed in a separate step.

```
$ git tag VersionNumber # e.g., "v2025.08"
$ git push # Push the commits
$ git push --tags # Push the tags
```

You delete a tag with the `git tag` command as well.

```
$ git tag --delete tagName # e.g., "v2025.08"
$ git push origin --delete tagName
```

## Git Help

The following two URLs show the online documentation for Git. The first URL is the online manual page for Git and the second URL is the complete Git documentation.

<https://git.github.io/htmldocs/git.html>

<https://git-scm.com/docs>

The Git command also has all of the documentation built into the command so you can access it from the command line without opening a browser.

To show the command line syntax and a list of common Git commands:

```
$ git help
```

To list all of the Git commands:

```
$ git help -a
```

To list guides or tutorials on various topics:

```
$ git help -g
```

For help with a specific command:

```
$ git help command
```

## Git Terminology

|                   |                                                                                                                                                                                                                                                                           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Commit            | Make the changes in the staging area permanent.                                                                                                                                                                                                                           |
| Head              | Is the most recent commit in the current branch. Since each branch has a head, HEAD in all capital letters refers to the head of the current branch.                                                                                                                      |
| Local             | Or local repository, refers to the developer's copy of the repository on their local system.                                                                                                                                                                              |
| Origin            | Is the default name Git uses to refer to a remote repository.                                                                                                                                                                                                             |
| Remote            | Refers to the remote repository, which is the same repository on a server somewhere. In our case, it is the Tax Analysis Tools repository on GitHub.                                                                                                                      |
| Repository        | Is any directory that has been initialized by Git using the <code>git init</code> command. Once initialized, the directory will have a subdirectory named <code>.git</code> where Git stores all the information it needs to track changes to the files in the directory. |
| Staging Area      | Also called the <i>index</i> or the <i>cache</i> . It is a temporary area where you "stage" changes to be included in the next commit.                                                                                                                                    |
| Working Directory | The directory containing the source files for the branch you are currently working on. Thus, it is the general term for the source code directory where you do your work. It is also the current branch in the local Git repository.                                      |

## Editing Tools

### VS Code

Visual Studio Code, usually called VS Code, is a popular, free editor for developers. There are many extensions that give it additional capabilities and interoperability with other tools, but it comes with build

in support for HTML, CSS, and JavaScript. For more information on VS Code, go to <https://code.visualstudio.com>.

## Installation

1. Go to <https://code.visualstudio.com/download>
2. Click on the correct install option (for Windows, all the options result in the same installer).
3. Click on the enormous VS Code button to download the installer.
4. Execute the installer
  - Check **Add to PATH**. This is needed to run VS Code from the command line by entering `code`.
  - Check **Add Open with Code action to Windows Explorer file context menu**. This allows you to right click on a file to open the file with VS Code.
  - Check **Add Open with Code action to Windows Explorer directory context menu**. This allows you to right click on a directory to open it with VS Code.
  - Click **Register Code as an editor for supported file types**. This makes VS Code the default editor for the supported file types.

## Configuration Settings

Synchronize your configuration settings across all the systems you use.

1. Click on the gear icon and select **Backup and Sync Settings**.
2. You will be prompted to sign in to a GitHub or Microsoft account. Select **Microsoft**.

## User Settings

User settings are only for the user, but apply in all projects that the user works on. User settings are stored in the file `VS Code settings` are stored in the file

`C:/Users/UserName/AppData/Roaming/Code/User/settings.json`.

|           |                           |              |
|-----------|---------------------------|--------------|
| Editor    | Bracket Pair Colorization | ?            |
| Terminal  | Default Profile Windows   | Ubuntu (WSL) |
| Workbench | Color Theme               | Light Modern |

## Workspace Settings

Workspace settings apply to all users working in the workspace. Workspace settings are stored in the file `.vscode/settings.json` at the top of the project directory. This is a workspace file and should be checked into the Git repository.

|        |                          |       |                                |
|--------|--------------------------|-------|--------------------------------|
| Editor | Format On Save           | False |                                |
| Editor | Tabsize                  | 4     | # Spaces per indentation level |
| Editor | Insert Spaces            | false | # Use tabs for indentation     |
| Editor | Detect Indentation       | true  | # Match existing indentation   |
| Files  | Insert Final Newline     | True  |                                |
| Files  | Trim Trailing Whitespace | True  |                                |

## Extensions

I use the following extensions. VS Code does not support printing, so you need to add an extension to provide the functionality. The Print extension adds print icons to the top banner of the editor panel. The ESLint and Prettier extensions are discussed below.

Print  
Prettier - Code Formatter  
ESLint

The following extensions may be useful; I haven't decided.

GitLens  
Code Spell Checker  
Jest  
GitHub Copilot  
GitHub Copilot Chat  
Open in Browser (by TechER)

### Command Summary

|                  |                               |
|------------------|-------------------------------|
| Ctrl + Shift + P | Command palette               |
| Ctrl + ,         | Open settings                 |
| Ctrl + S         | Save file                     |
| Ctrl + K S       | Save all                      |
| Shift + Alt + F  | Format file                   |
| Ctrl + G         | Go to line                    |
|                  |                               |
| Ctrl + B         | Show/hide side bar            |
| Ctrl + J         | Show/hide the panel           |
| Ctrl + `         | Show/hide terminal            |
| Ctrl + Alt + I   | Show/hide Copilot chat window |
| F11              | Toggle full screen            |

## Node and NPM

Note: the tools described in this section do not work when the repository is on cloud storage (e.g., Google Drive).

For now, the following steps should be done in your local repository and not checked into Git.

The Node Package Manager (NPM) is a program that lets you download JavaScript libraries from the NPM registry and use them in JavaScript projects. NPM is bundled with Node, so NPM will be installed when you install Node. Node, or Node.js, is a JavaScript runtime environment and web server, which allows you to test server-side JavaScript code on your local system.

### Installation

1. Go to <https://nodejs.org>
2. Execute the installer
3. In a terminal window, initialize the package manager (NPM) for use with your project. This step only needs to be done once, so this step has already been done. This step creates the file `package.json`, which NPM uses to track which packages have been installed and their dependencies.

```
$ cd TAXToolsDirectory
$ npm init -y
```

4. Other NPM commands:

```
$ npm install packageName
$ npm list
$ npm outdated # List packages that need to be updated
```

```
$ npm uninstall packageName
$ npm update [packageName]
```

## Prettier

Prettier - Code Formatter is the code formatter used by the Tax Analysis Tools.

1. Install the prettier package. The `save-dev` option indicates that the package is only used during development and will not be distributed with the project.

```
$ cd TAXToolsDirectory
$ npm install prettier --save-dev
```

2. Run Prettier on a file.

```
$ npx prettier filename
```

3. In VS Code, install the extension Prettier – Code Formatter and change the following configuration settings. Restart VS Code. Use the keyboard shortcut Shift + Alt + F to format the current document and use Ctrl + Z to undo the change.

|        |                   |                           |
|--------|-------------------|---------------------------|
| Editor | Format On Save    | false                     |
| Editor | Default Formatter | Prettier – Code Formatter |

## ESLint

NOTE: This does not work when the source code is hosted on Google Drive. Clone a new repository on the local system and use ESLint there.

ESLint is the code checker used for the Tax Analysis Tools.

1. Install the ESLint package. The `save-dev` option indicates that the package is only used during development and will not be distributed with the project.

```
$ cd TAXToolsDirectory
$ npm install eslint --save-dev
```

2. Create a default configuration for ESLint.

```
$ npx eslint --init
```

3. Run ESLint on a file.

```
$ npx eslint filename
```

4. In VS Code, install the extension ESLint. Restart VS Code.

## Git

Git and GitHub are the source code version control tools used for the Tax Analysis Tools. This section describes the installation of Git, but there is a complete discussion on how these tools are used with the Tax Analysis Tools earlier in this document.

### Installation

1. Go to <https://git-scm.com/install/windows>.
2. Select the Windows tab.
3. Click on **Click here to download...**
4. Execute the installer

- Git will be installed at: C:/Users/<UserName>/AppData/Local/Programs/Git. You may need to know this if one of the tools is not able to find the Git commands.