Introduction to GitHub Actions

Revision 3.2 – 04/08/23

Tech Skills Transformations LLC / Brent Laster

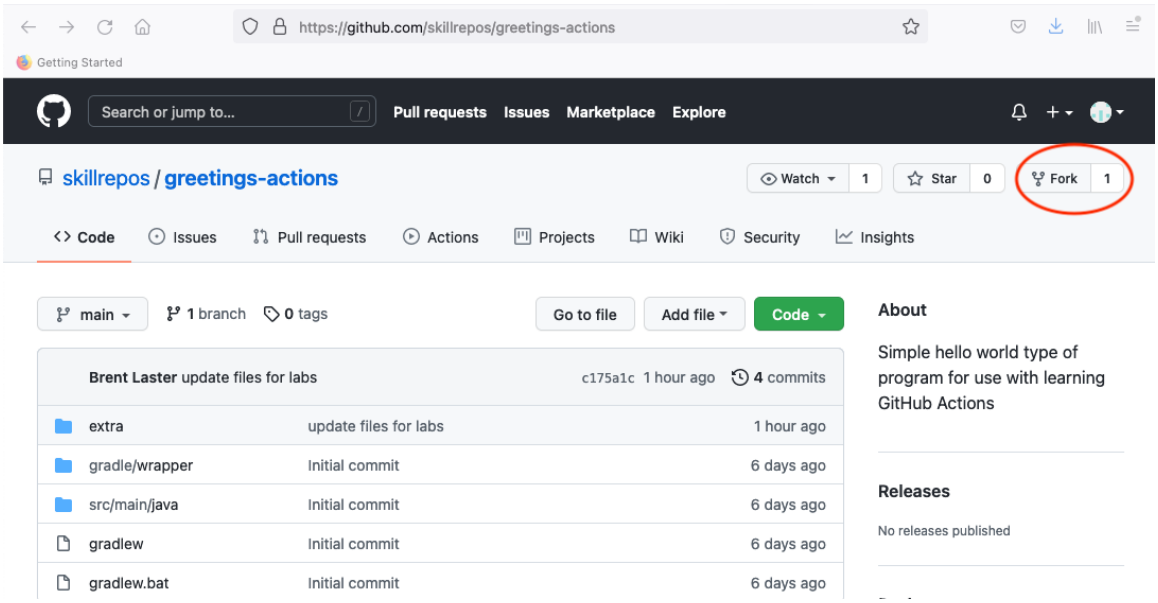
Important Prerequisite: You will need a GitHub account for this. (Free tier is fine.)

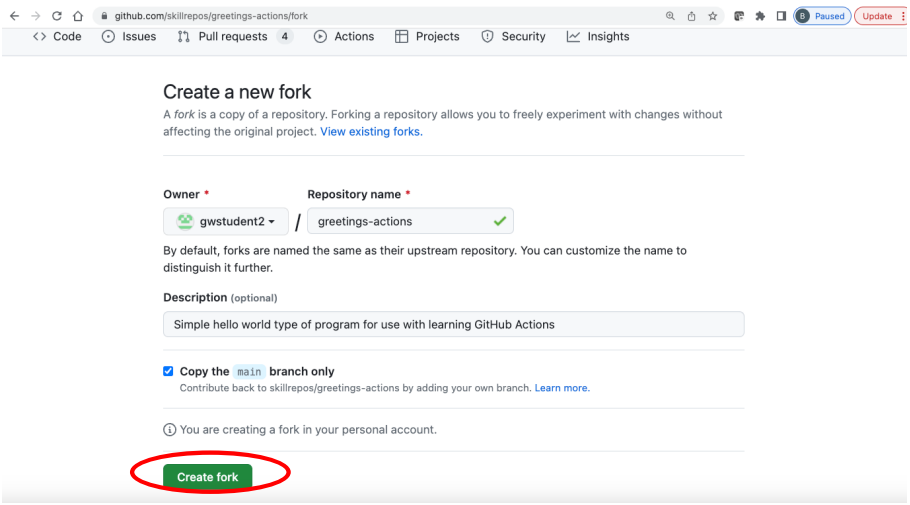
Lab 1 – Creating a simple example

Purpose: In this lab, we'll get a quick start learning about CI with GitHub Actions by creating a simple project that uses them. We'll also see what a first run of a workflow with actions looks like.

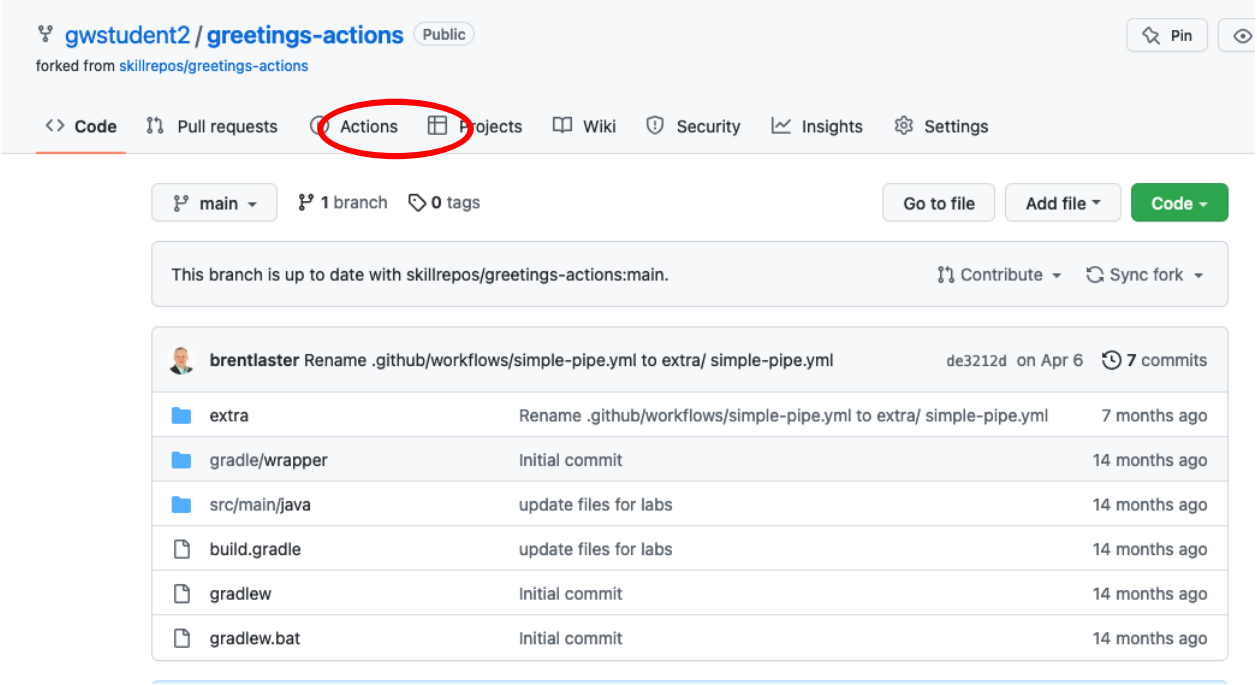
1. Log in to GitHub with your GitHub id

2. Go to https://github.com/skillrepos/greetings-actions and fork that project into your own GitHub space. Click on the *Fork* button in the upper right. On the next screen, you can just accept the options and click on the green *Create fork* button.

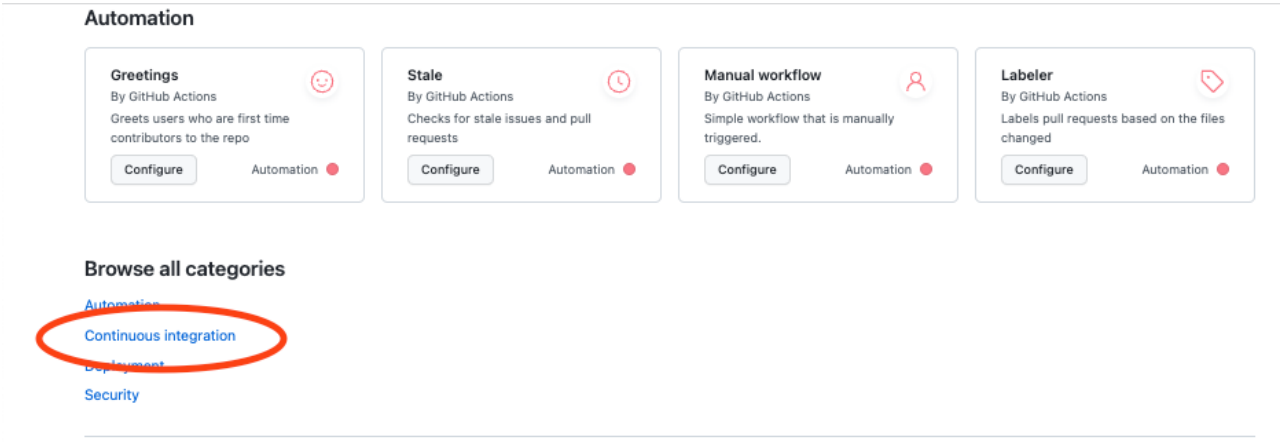




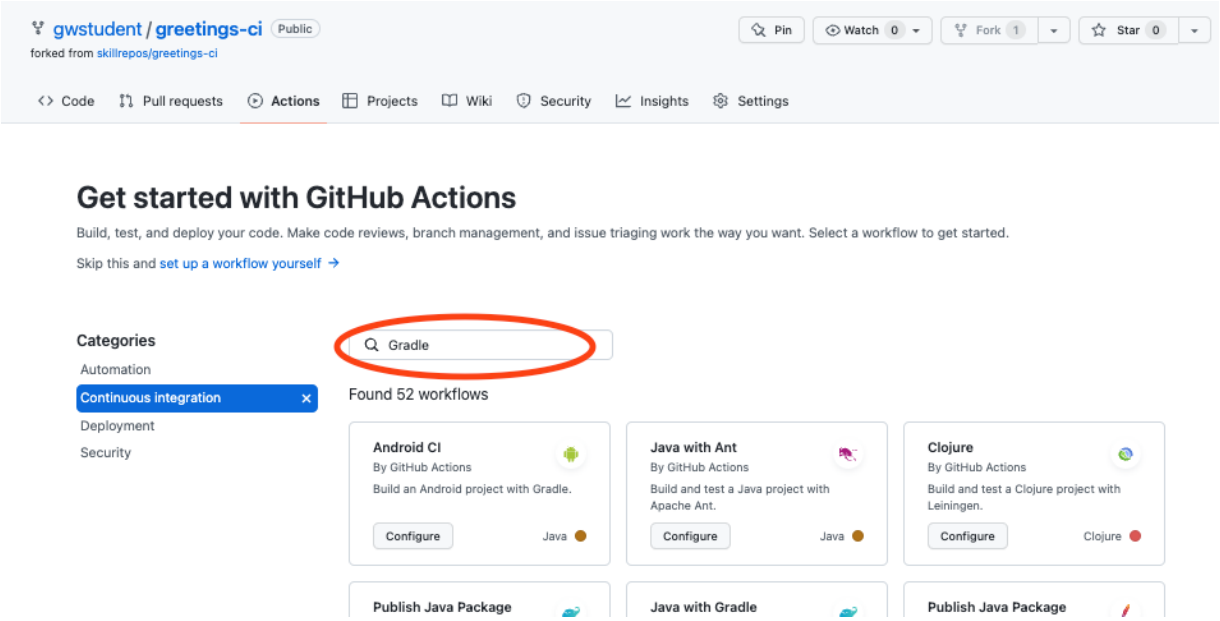
3. We have a simple java source file named *echoMsg.java* in the subdirectory *src/main/java*, a Gradle build file in the root directory named *build.gradle,* and some other supporting files. We could clone this repository and build it manually via running Gradle locally. But let's set this to build with an automatic CI process specified via a text file. Click on the *Actions* button in the top menu under the repository name.



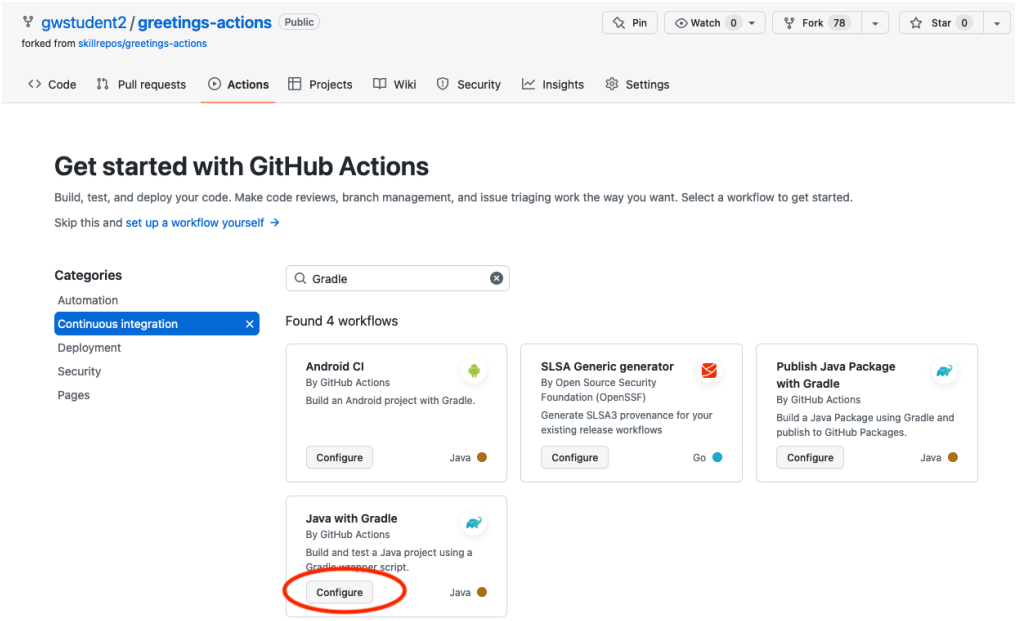
4. This will bring up a page with categories of starter actions that GitHub thinks might work based on the contents of the repository. We'll select a specific CI one. Scroll down to near the bottom of the page under "Browse all categories" and select "Continuous integration".



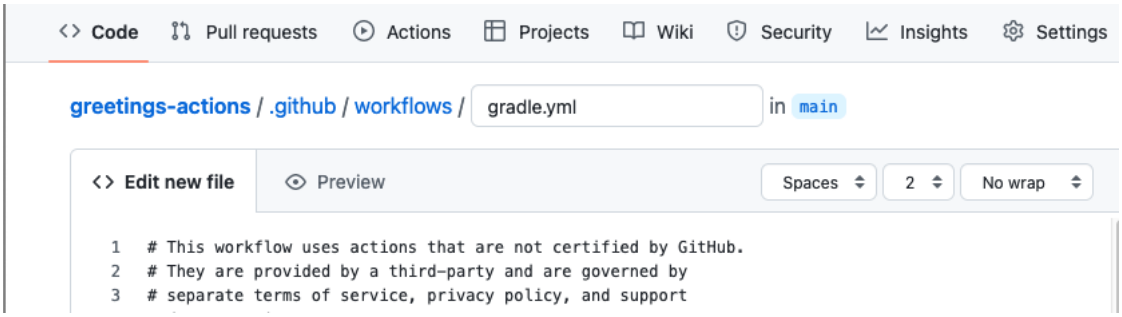
5. In the CI category page, let's search for one that will work with Gradle. Type "Gradle" in the search box and press Enter.



6. From the results, select the “Java with Gradle” one and click the “Configure” button to open a predefined workflow for this.



7. This will bring up a page with a starter workflow for CI that we can edit as needed. There are two edits we'll make - changing the name of the file and the name of the workflow. In the top section where the path is, notice that there is a text entry box around “gradle.yml”. This is the current name of the workflow. Click in that box and edit the name to be simple-pipe.yaml. (You can just backspace over or delete the name and type the new name.)



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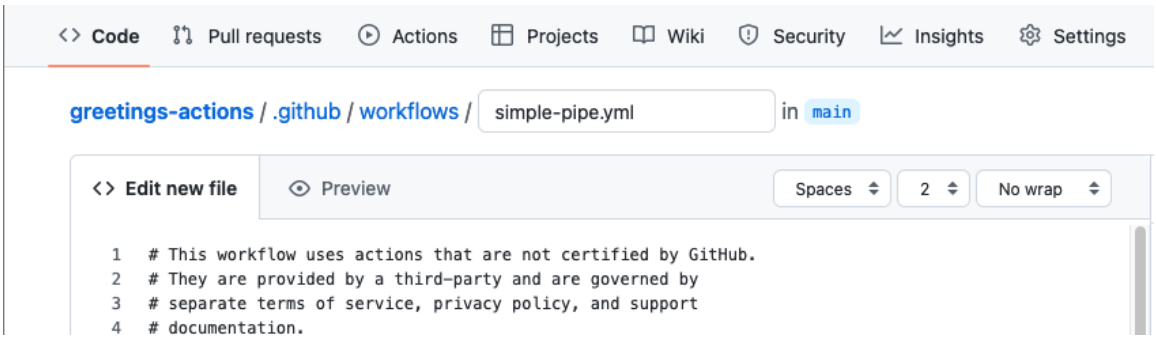
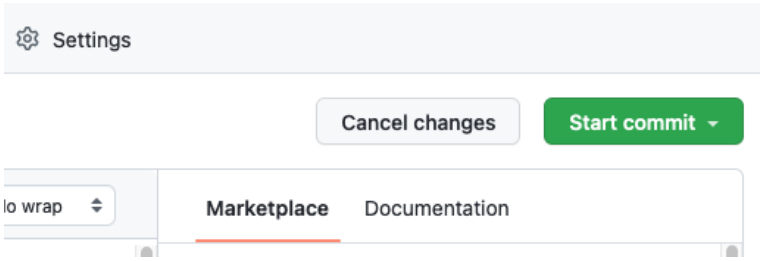


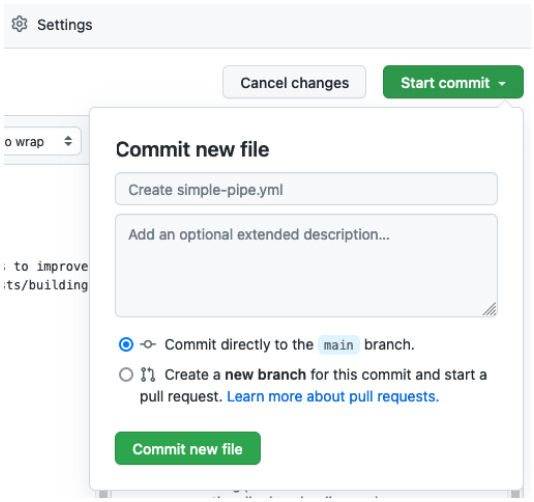
8. Now, edit the name of the workflow - change line 8 from "**name: Java CI with Gradle**" to "**name: Simple Pipe**".

```
5  # This workflow will build a Java project
6  # For more information see: https://docs.
7
8  name: Java CI with Gradle
9
10 on:
11   push:
```

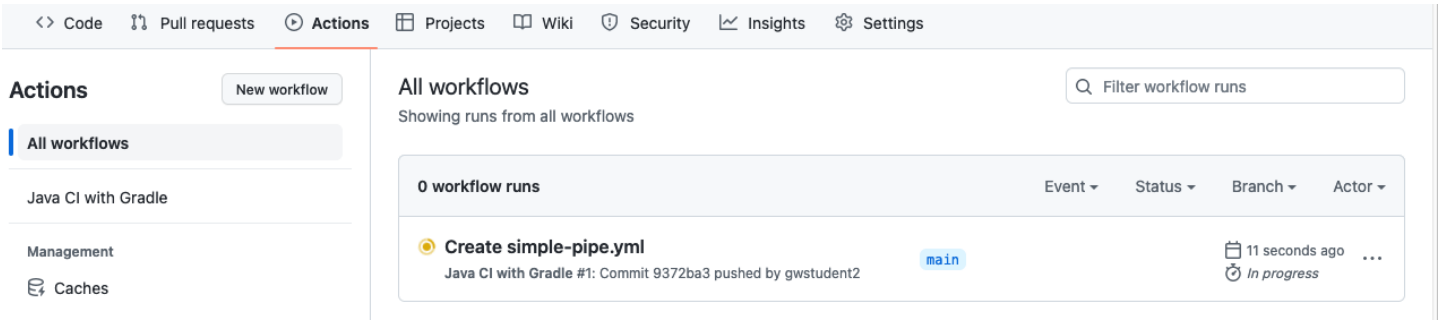
```
5  # This workflow will build a Java project
6  # For more information see: https://docs.
7
8  name: Simple Pipe
9
10 on:
11   push:
```

9. Commit the new workflow via the "Start commit" button in the upper right. In the dialog that comes up, you can enter an optional comment if you want. Leave the "Commit directly…" selection checked and then click on the "Commit new file" button.

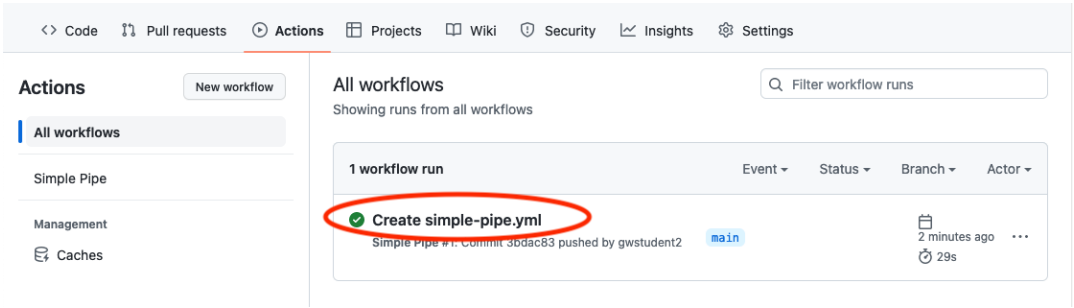




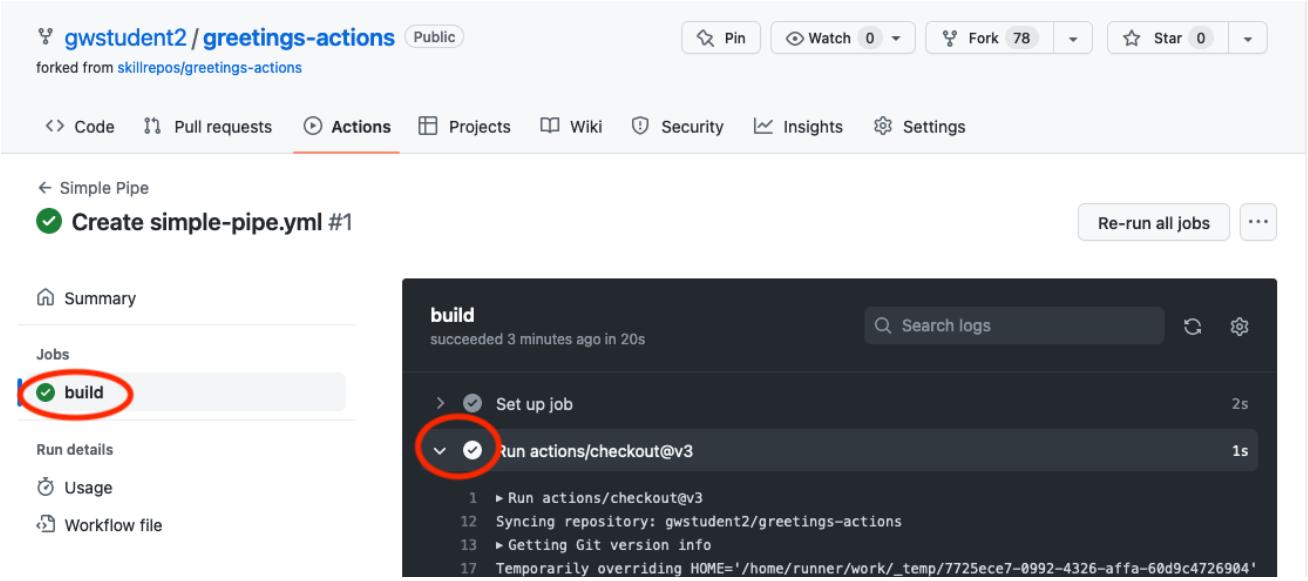
10. Since we've committed a new file and this workflow is now in place, the "on: push:" event is triggered and the CI automation kicks in. Click on the Actions menu again to see the automated processing happening.



11. After a few moments, the workflow should succeed. (You may need to refresh your browser.) After it is done, you can click on the commit message for the run to get to the details for that run. (You can ignore the warnings about 'save-state'.)



12. From here, you can click on the build job in the graph or the "build" item in the list of jobs to get more details on what occurred on the runner system. You can expand any of the steps in the list to see more details.



Lab 2 – Learning more about Actions

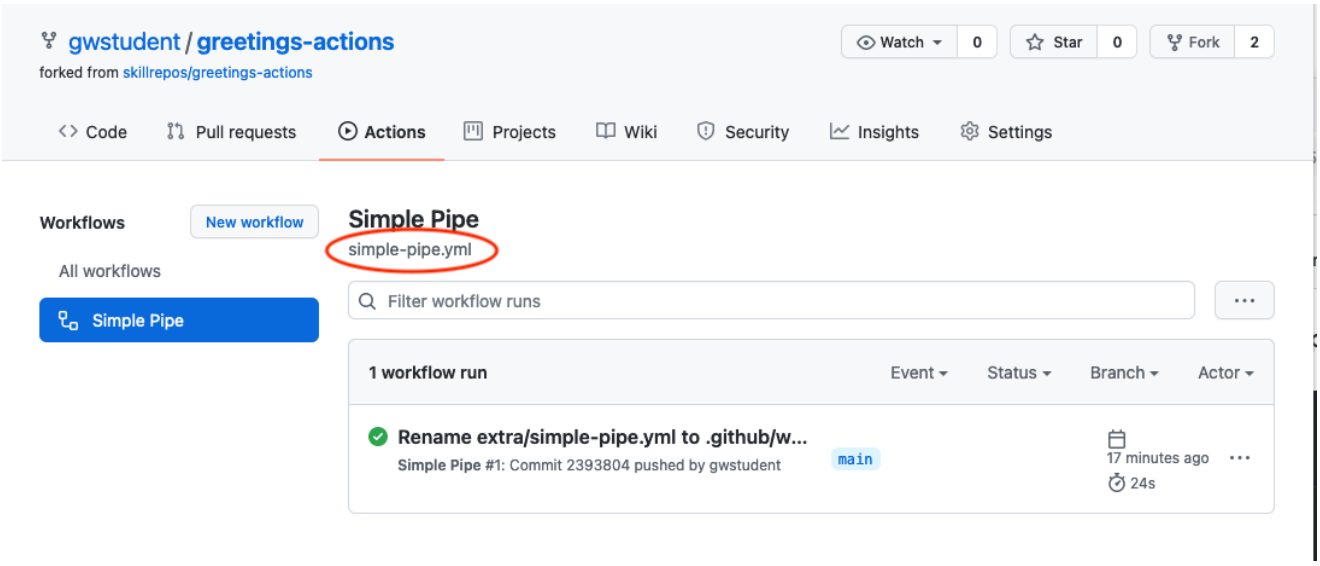
Purpose: In this lab, we'll see how to get more information about actions and how to update our workflow to use others.

1. We're going to explore one way in GitHub to update a workflow and add additional actions into it. Start out by opening up the workflow file simple-pipe.yml. There are multiple ways to get to it but let's open it via the Actions screen.

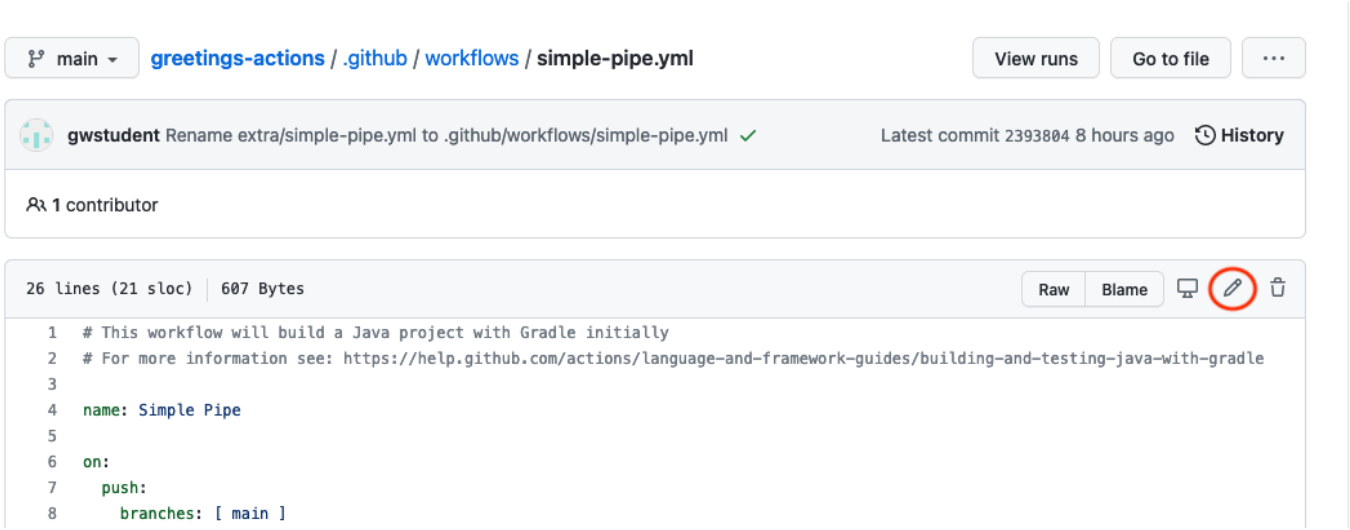
   In your GitHub repository, click the Actions button at the top if not already on the Actions screen.

   Under "All workflows", select the "Simple Pipe" workflow.

   After that, select the "simple-pipe.yml" link near the middle top.



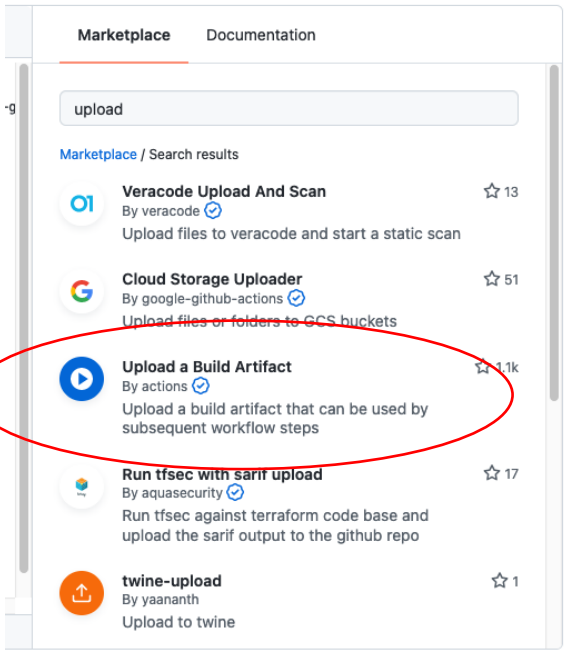
2. Once the file opens up, click on the pencil icon in the top right to edit it.

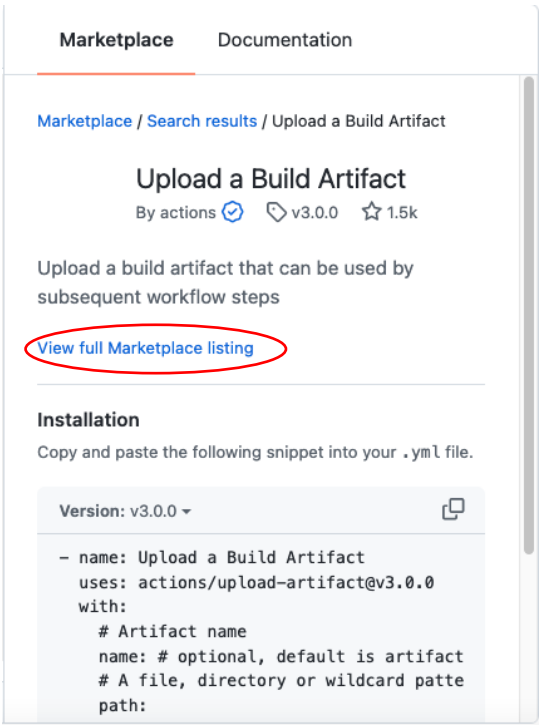


3. You'll now see the file open up in the editor, but also to the right, you should see a new pane with references to GitHub Actions. We're going to add a job to our workflow to upload an artifact. Let's find actions related to uploading.

   In the "Search Marketplace for Actions" box on the upper right, enter "Upload" and see what's returned.

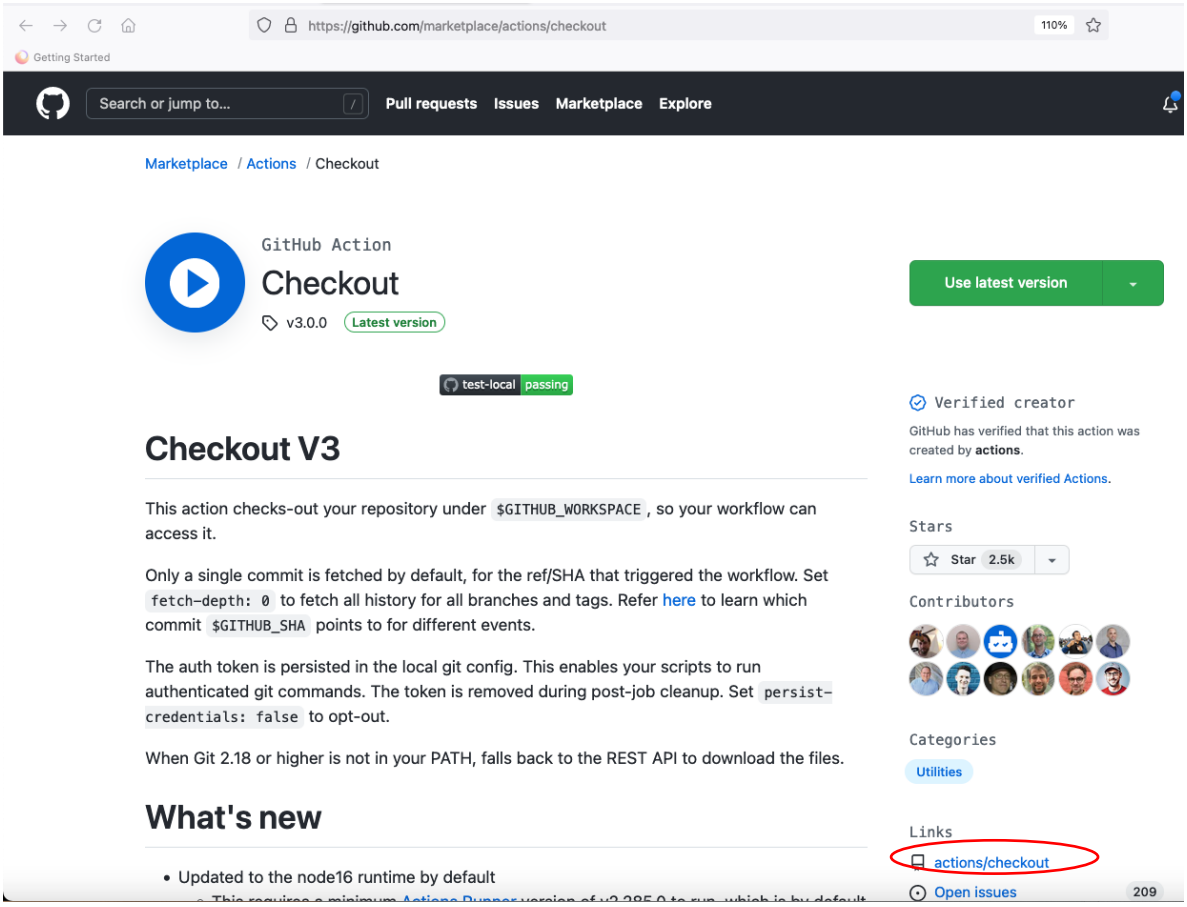
   Next, click on the "Upload a Build Artifact" item. Take a look at the page that comes up from that. Let's look at the full listing on the Actions Marketplace. Click on the "View full Marketplace listing".



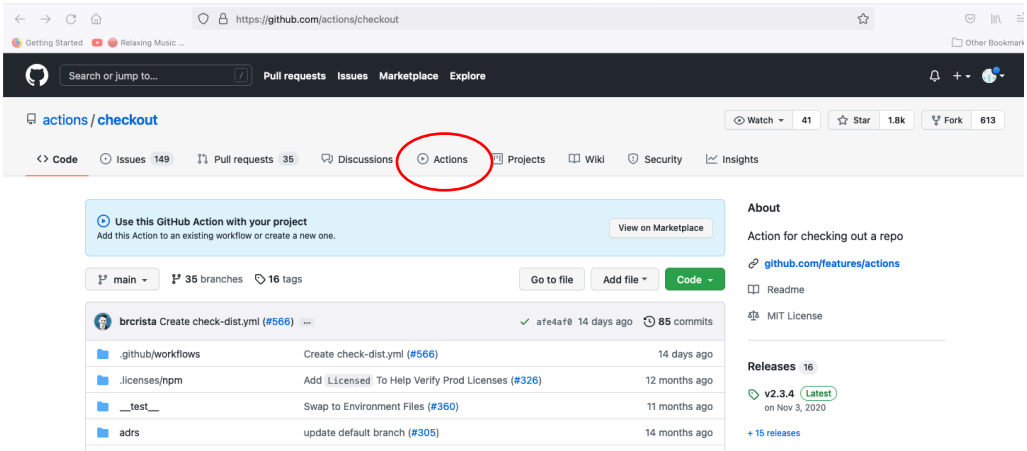


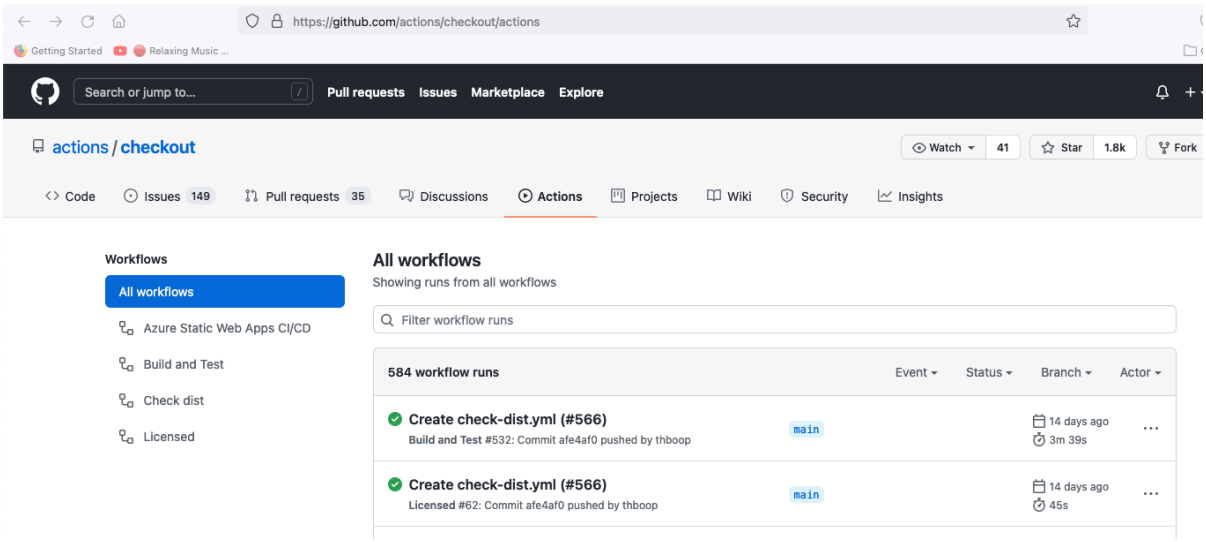
4. This should open up the full GitHub Actions Marketplace listing for this action. Notice the URL at the top - https://github.com/marketplace/actions/upload-a-build-artifact. You can use this same relative URL to see other actions that are in the marketplace. For example, let's look at the checkout one we're already using. Go to https://github.com/marketplace/actions/checkout

   Then click on the "actions/checkout" link under "Links" in the lower right.



5. This will put you on the screen for the source code for this GitHub Action. Notice there is also an Actions button here. GitHub Actions use workflows that can use other GitHub Actions. Click on the Actions button to see the workflows that are in use/available.

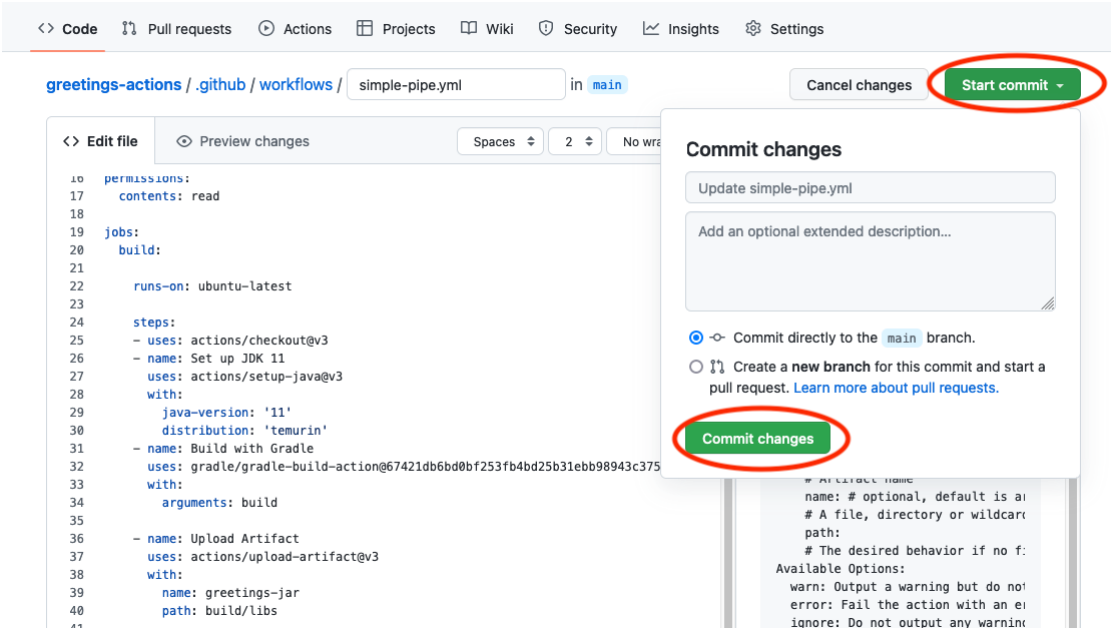




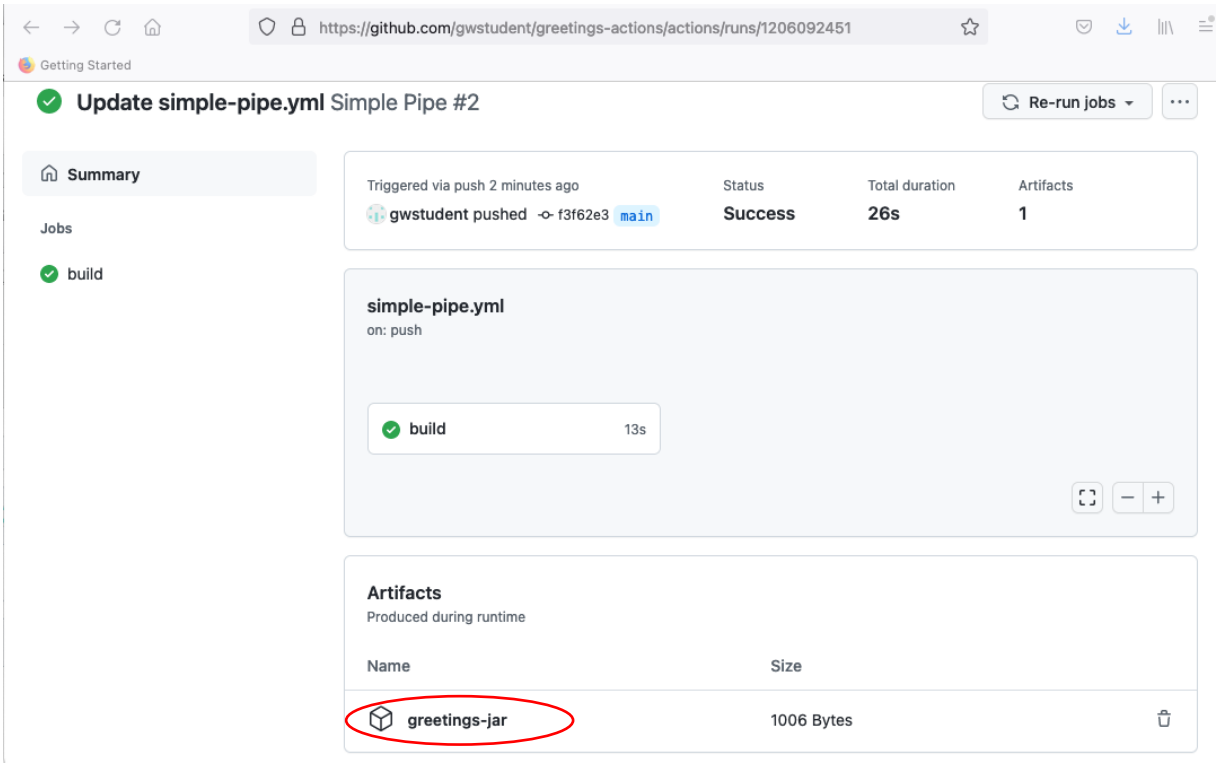
6. Switch back to the browser tab where you are editing the workflow for greetings-actions. Update the build job to include a new step to use the "upload-artifact" action to upload the jar the build job creates. To do this, add the following lines inline with the build job steps. **Pay attention to the indenting.** See the screenshot (lines 36-40) for how this should look afterwards. (Your line numbers may be different.)

```
- name: Upload Artifact
  uses: actions/upload-artifact@v3
  with:
    name: greetings-jar
    path: build/libs
```

7. Click on the green "Start commit" button in the upper right. In the dialog that comes up, add a different commit message if you want, then click the green "Commit changes" button to make the commit.

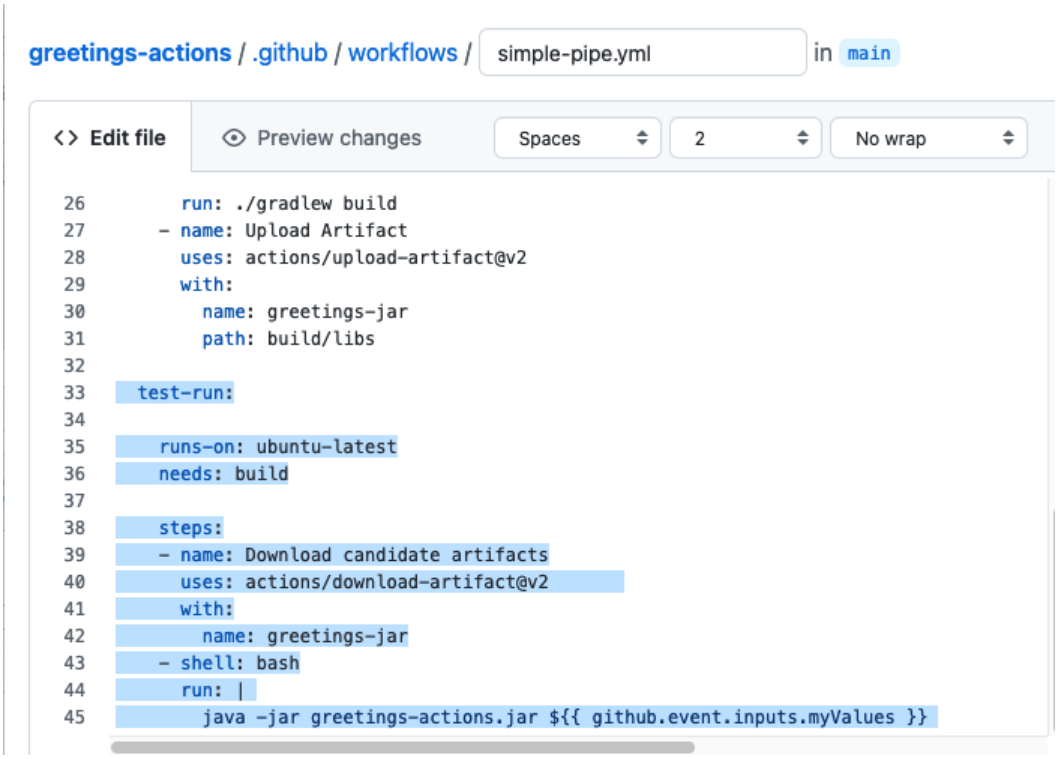


8. Switch to the "Actions" tab in your repository to see the workflow run. After a few moments, you should see that the run was successful. Click on the title of that run "Update simple-pipe.yml" (or whatever your commit message was). On the next screen, in addition to the graph, there will be a new section called "Artifacts" near the bottom. You can download the artifact from there. Click on the name of the artifact to try this.

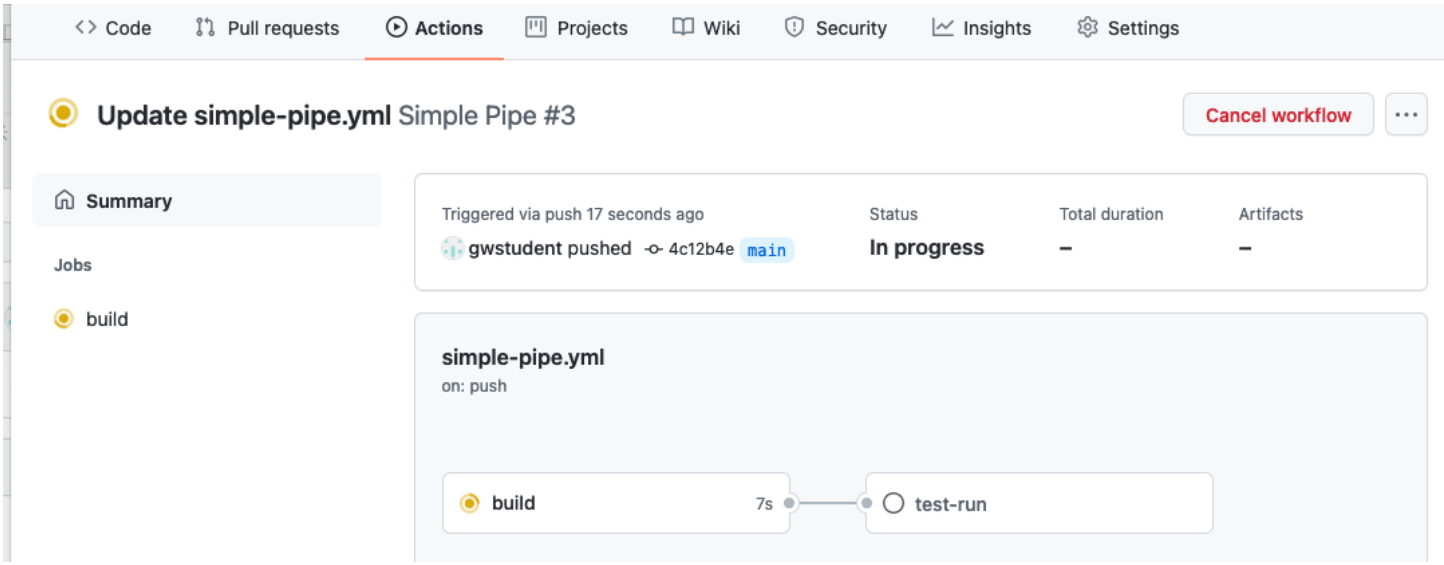


9. Now let's add a new job to our workflow (in simple-pipe.yml) to download this artifact and execute the jar file. The code is straightforward because there's already a "download_artifact" action for us to use. And we can just use a shell run command to execute "java -jar" on this. Add the code below into your workflow, indenting test-run to line up with the "build" job entry above it. See also the screenshot further down. (For convenience, this code is also in "extra/test-run.txt".) Again, pay attention to indentation.

```
test-run:

  runs-on: ubuntu-latest
  needs: build

  steps:
  - name: Download candidate artifacts
    uses: actions/download-artifact@v2
    with:
      name: greetings-jar
  - shell: bash
    run: |
      java -jar greetings-actions.jar ${{ github.event.inputs.myValues }}
```



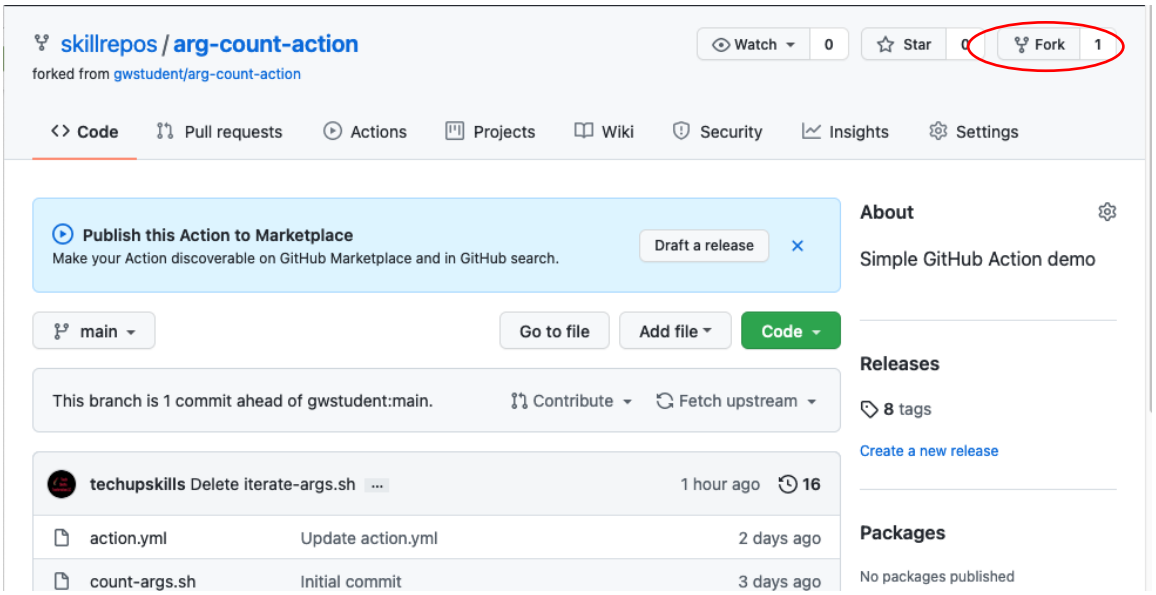
10. Click on the green "Start commit" button as before, commit the change, and then switch over the "Actions" tab. Click on the latest entry. You should see in the workflow graph two jobs now. (Note there is also a button to cancel the workflows.). Eventually, both should succeed.



Lab 3: Adding your own action

Purpose: in this lab, we'll see how to create and use a custom GitHub Action.

1. First, we'll fork the repo for a simple action that displays a count of the arguments passed into a function. Go to https://github.com/skillrepos/arg-count-action and then Fork that repository into your own GitHub space. Again, you can just accept the defaults and click on the "Create fork" button.

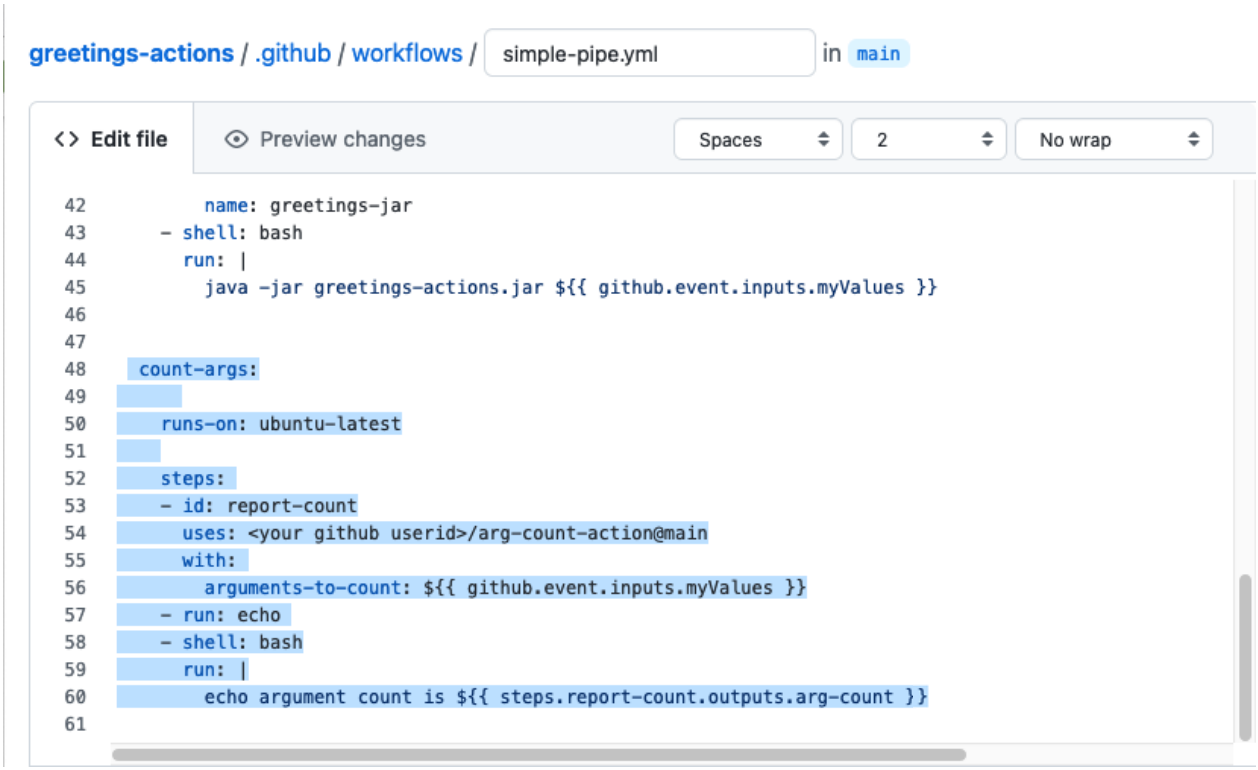


2. In your fork of the repository, look at the files here. We have a one-line shell script (for illustration) to return the count of the arguments - "count-args.sh." And we have the primary logic for the action in the "action.yml" file.

   Take a look at the action.yml file and see if you can understand what its doing. The syntax is mostly what we've seen in our workflow up to this point.

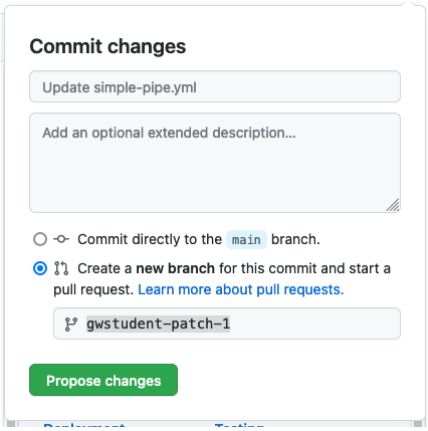
3. Switch back to the file for your original workflow (go back to the *greetings-actions* project and edit the *simple-pipe.yml* file). Let's add the code to use this custom action to report the number of arguments passed in. Edit the file and add the code shown below (again indenting the first line 2 spaces to align with the other job names). (For convenience, this code is also in "greetings-actions/extra/count-args.txt".) **For now, just leave the text exactly as is so we can see what errors look like.**

```
count-args:

  runs-on: ubuntu-latest

  steps:
  - id: report-count
    uses: <your github userid>/arg-count-action@main
    with:
      arguments-to-count: ${{ github.event.inputs.myValues }}
  - run: echo
  - shell: bash
    run: |
      echo argument count is ${{ steps.report-count.outputs.arg-count }}
```

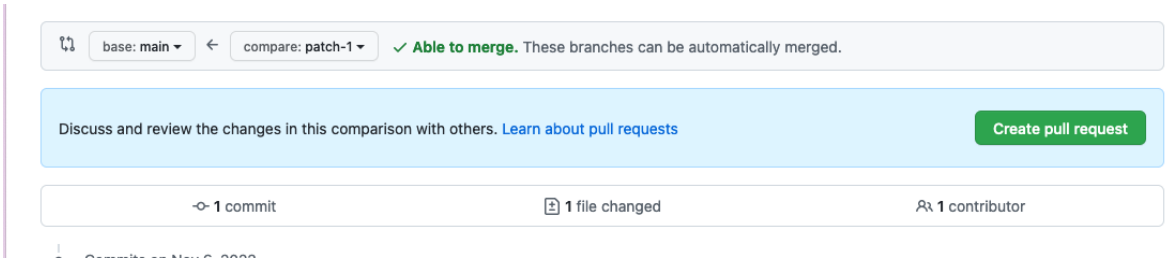


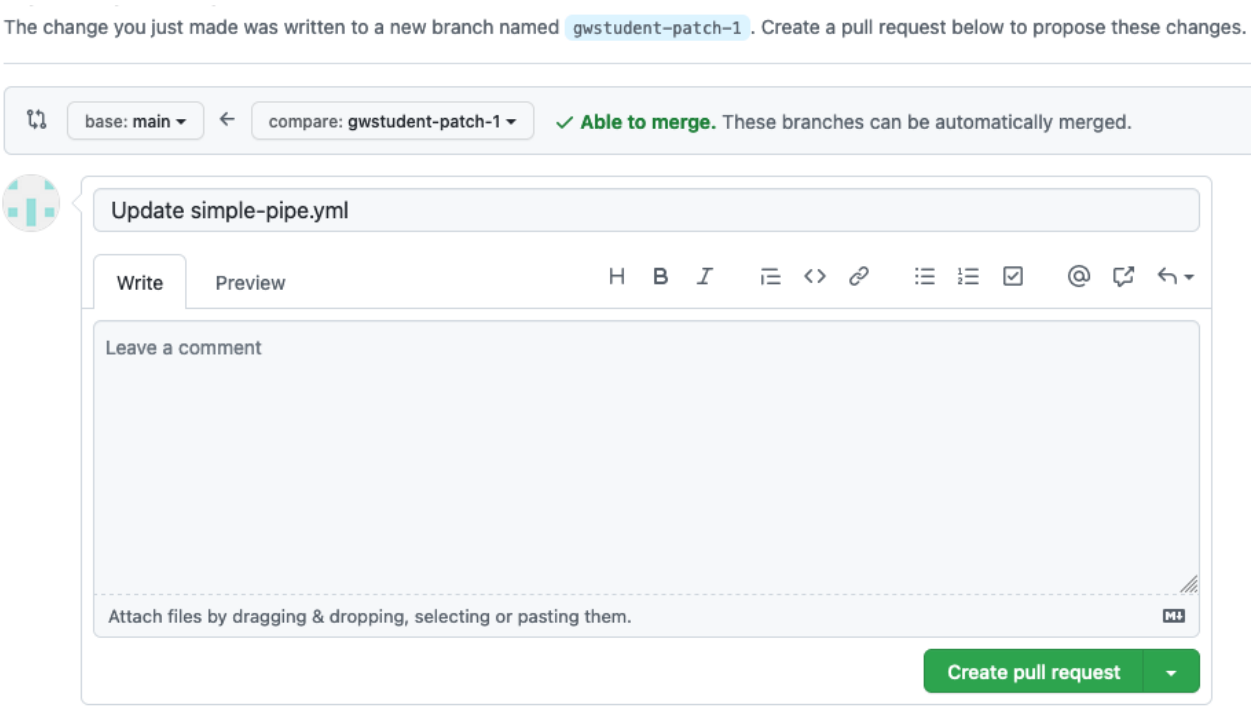
In this case, we call our custom action (<your github repo/arg-count-action>), using the latest from the main branch.

4. Let's use a pull request to merge this change. Click on the green "Start commit" button, but in the "Commit changes" dialog, click on the bottom option to "Create a new branch for this commit and start a pull request." Change the proposed branch name if you want and then click on "Propose changes".

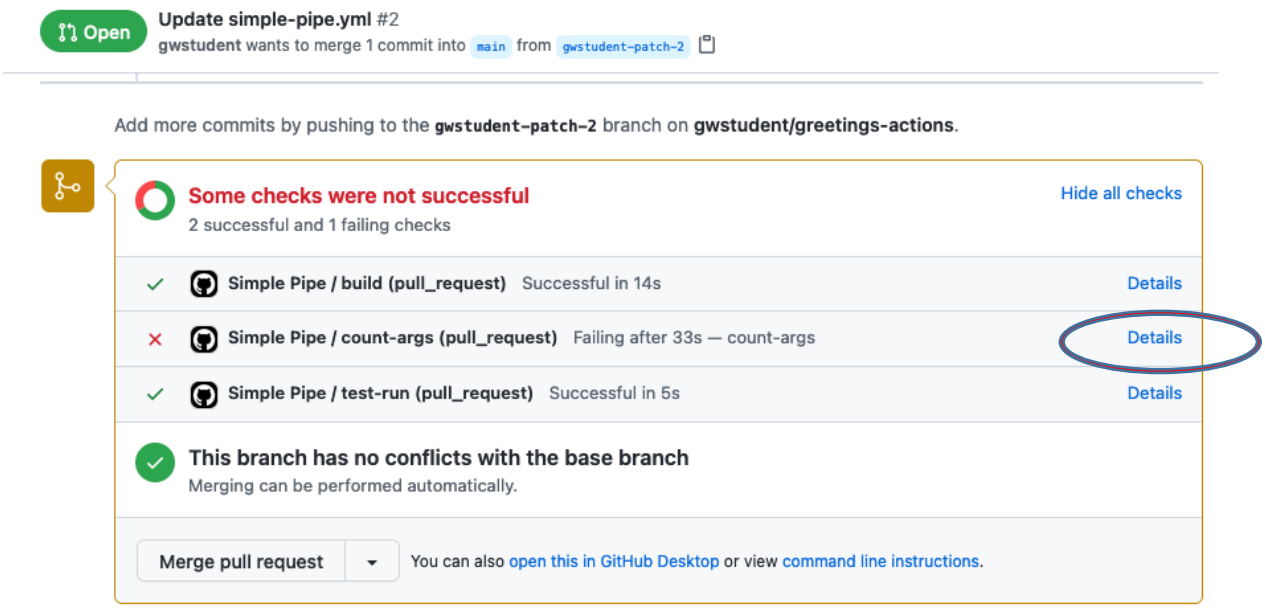


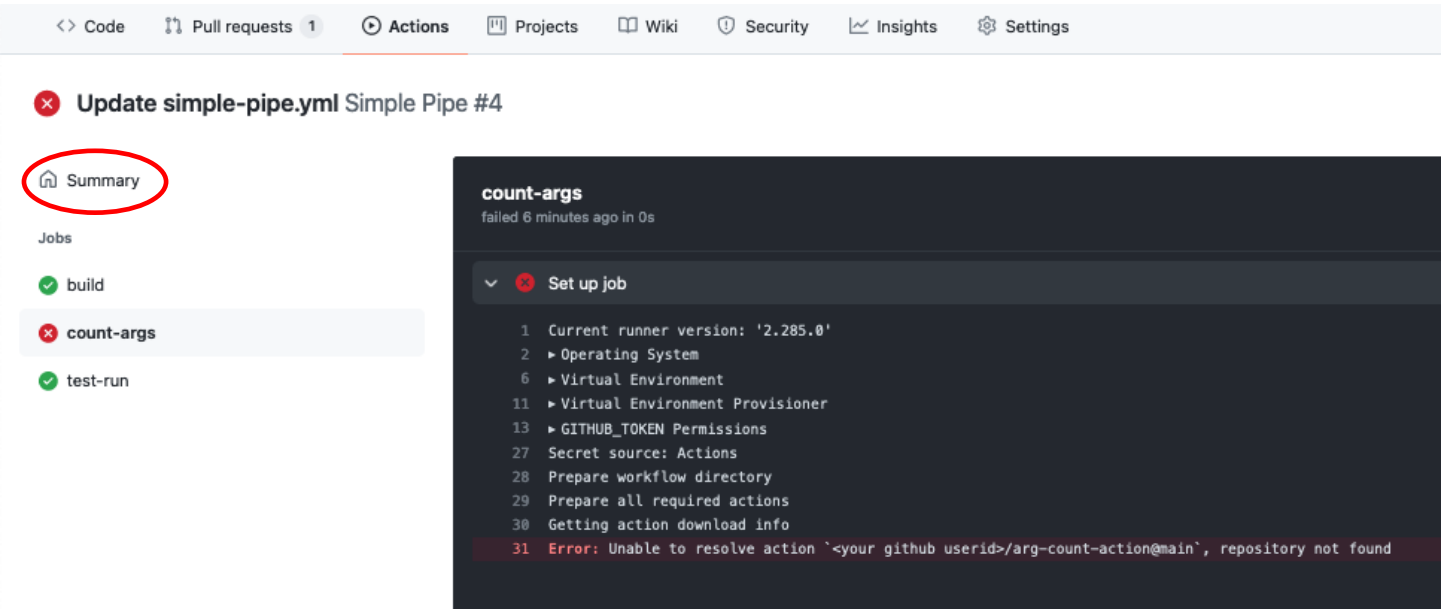
5. In the next screen, click on the "Create pull request" button. In the following screen, update the comment if you want and then click on the "Create pull request" button. You'll then see it run through the jobs in our workflow as prechecks for merging.



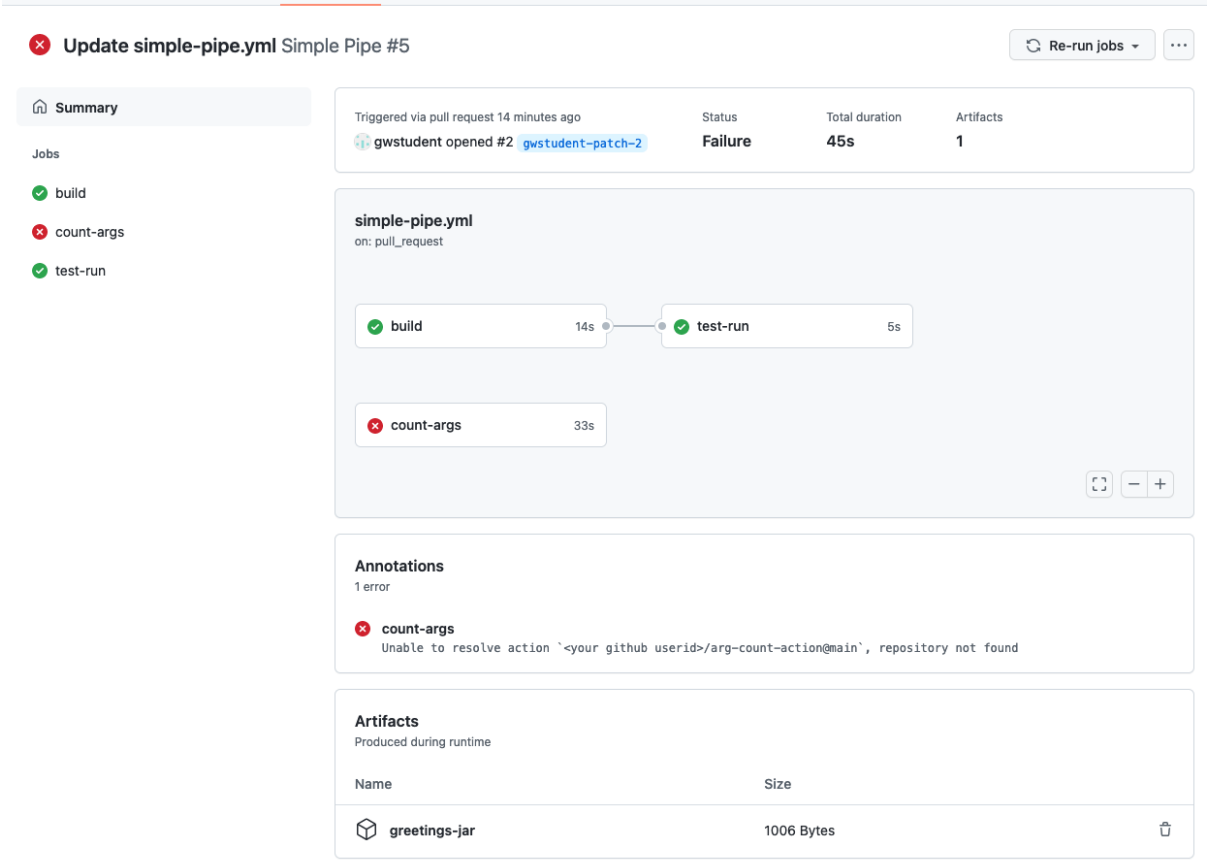


6. Click on the link for "Details" on the right of the line with the failure to see the logs that are available. You can then see the error at the bottom of the log.



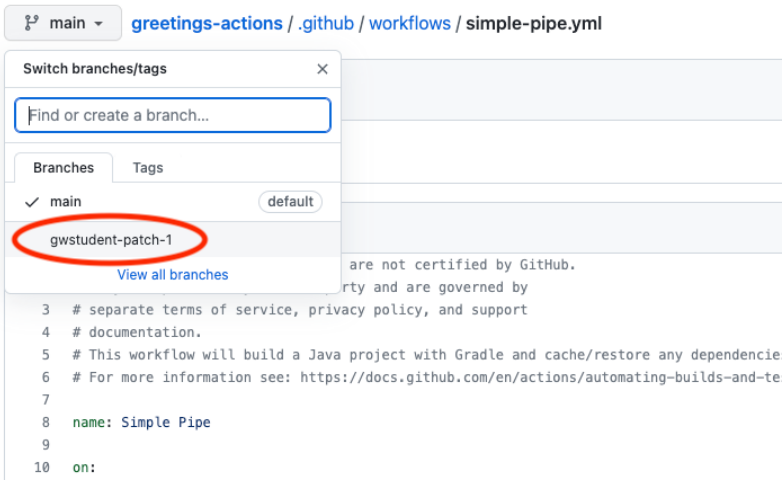


7. In the left column, click on the "Summary" link. This will take you back to the main graph page where you can also see the error.



8. So, before we can merge the PR, we need to fix the code. Go back to the "Actions" tab at the top, select the "Simple Pipe" workflow on the left, and then select the **simple-pipe.yaml** file (if not already

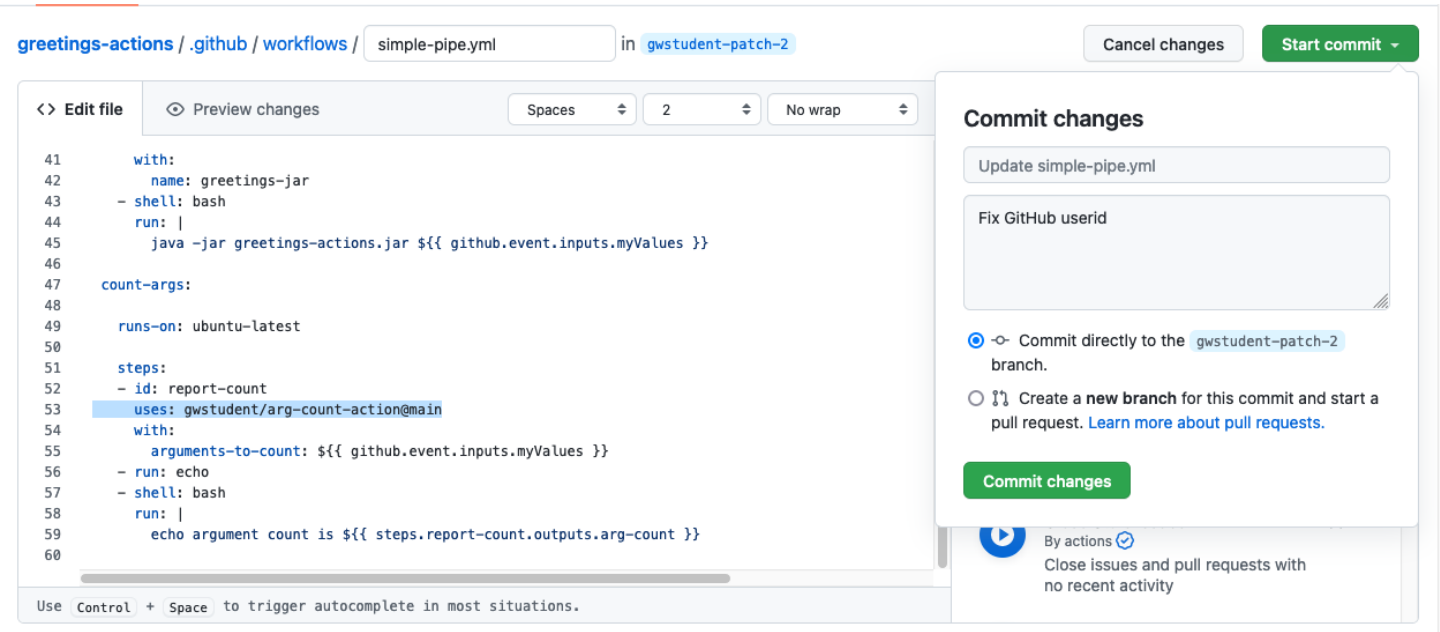
there) and **switch to the patch branch that you created for the pull request.** (Alternatively, you can select the file via the Code tab.)



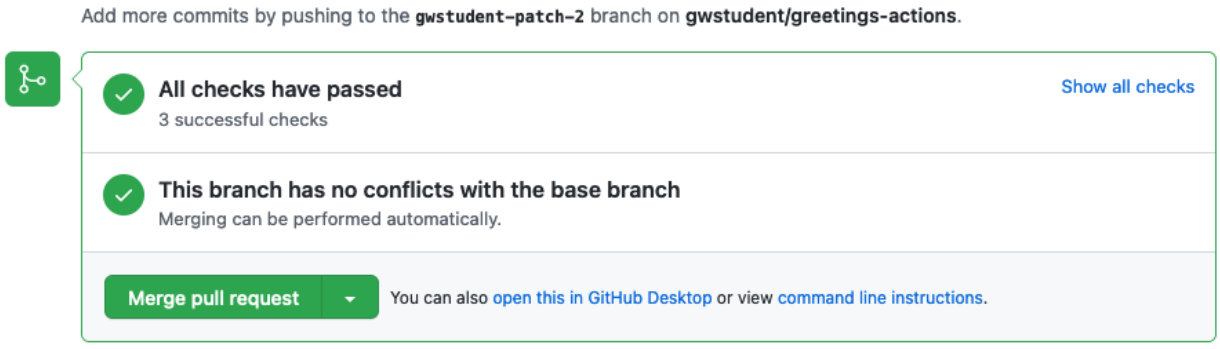
9. Edit the simple-pipe.yml file (use the pencil icon). Then update the line that has "uses : <your github userid>/arg-count-action@main" to actually have your GitHub userid in it.

```
47    count-args:
48
49      runs-on: ubuntu-latest
50
51      steps:
52      - id: report-count
53        uses: gwstudent/arg-count-action@main
54        with:
55          arguments-to-count: ${{ github.event.inputs.myValues }}
56      - run: echo
57      - shell: bash
58        run: |
59          echo argument count is ${{ steps.report-count.outputs.arg-count }}
60
```

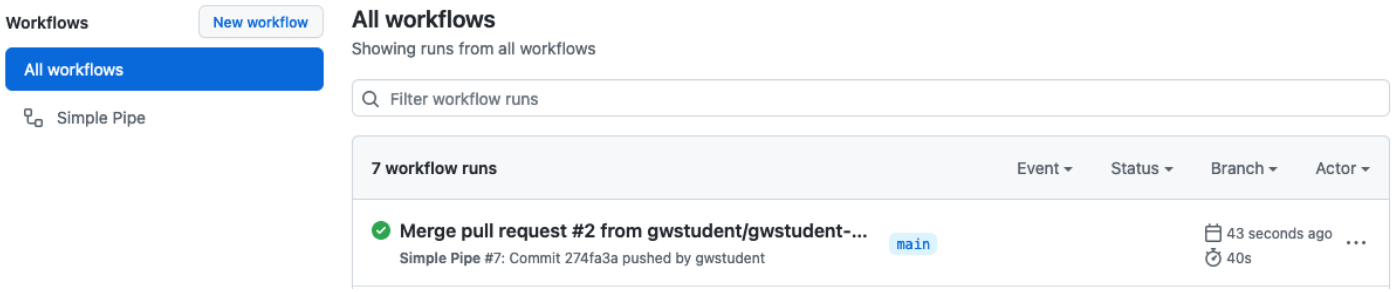
10. When you're done, click on the green "Start commit" button, add in a comment if you want, leave the selection set to "Commit directory to the … branch" so it will go in to the same patch branch as before. Then select "Commit changes".



11. Now click on the "Pull requests" link at the top of the page and select the Pull Request again. Eventually all the checks should complete. You can now choose to "Merge pull request", confirm the merge and delete the branch.



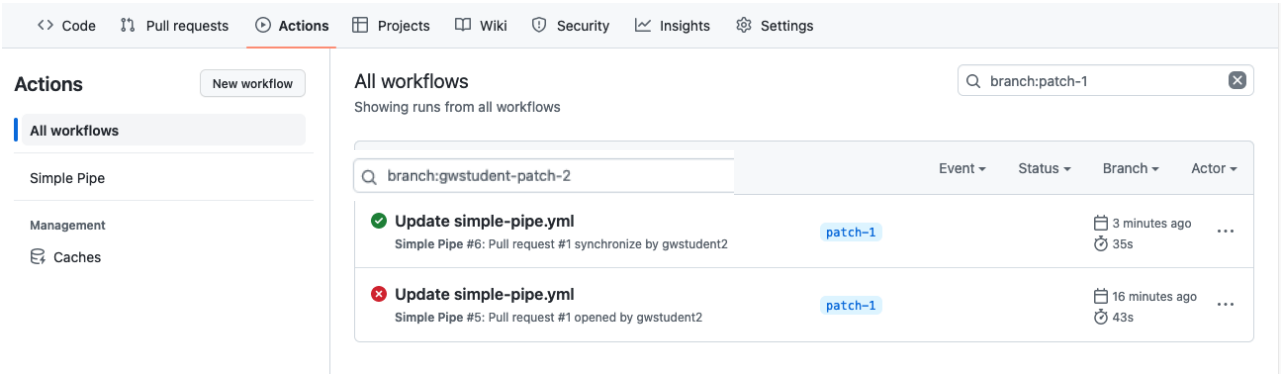
Afterwards, you should see that a new run of the workflows in main has been kicked off and will eventually complete.



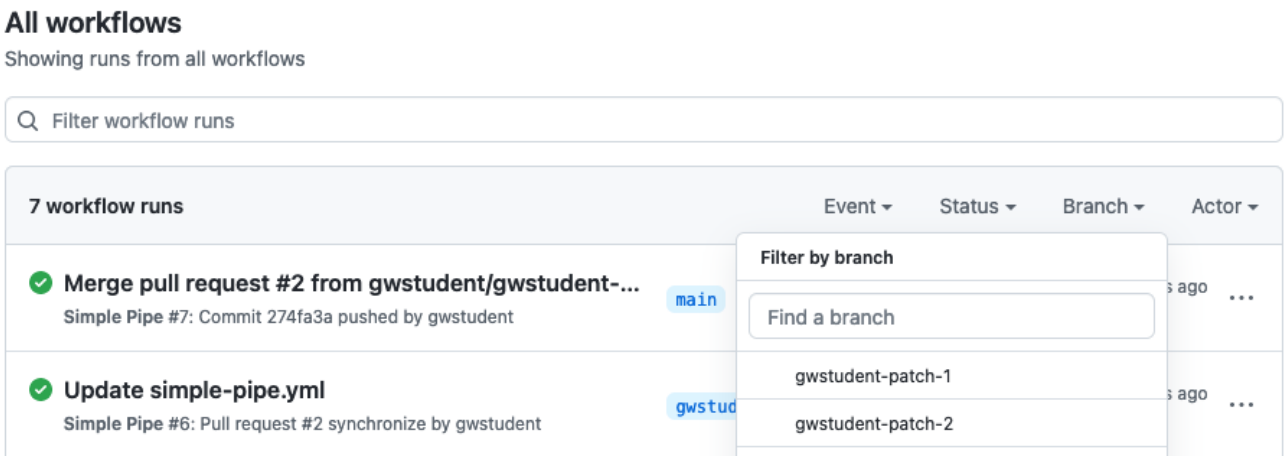
Lab 4: Exploring logs

Purpose: In this lab, we'll take a closer look at the different options for getting information from logs.

1. If not already there, switch back to the Actions tab. To the right of the list of workflows is a search box. Let's execute a simple search - note that only certain keywords are provided and not a complete log search. Let's search for the workflow runs that were done for the branch that you used for the Pull Request in the last lab. Enter "**branch:<patch-branch-name>"** (no spaces) in the search box and hit enter.

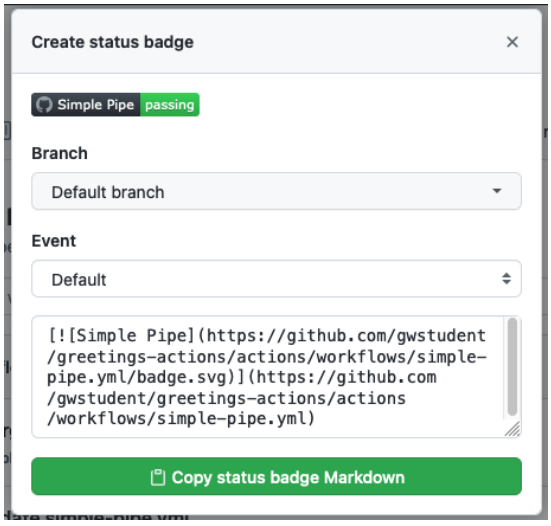


2. Click on the "X" at the right end of the box to clear the entry. You can also accomplish the same thing by clicking on the items in the "workflow run results" bar. Clicking on one of the arrows next to them will bring up a list of values to select from that will also filter the list. Try clicking on some of them. Click on the "X" again when done.

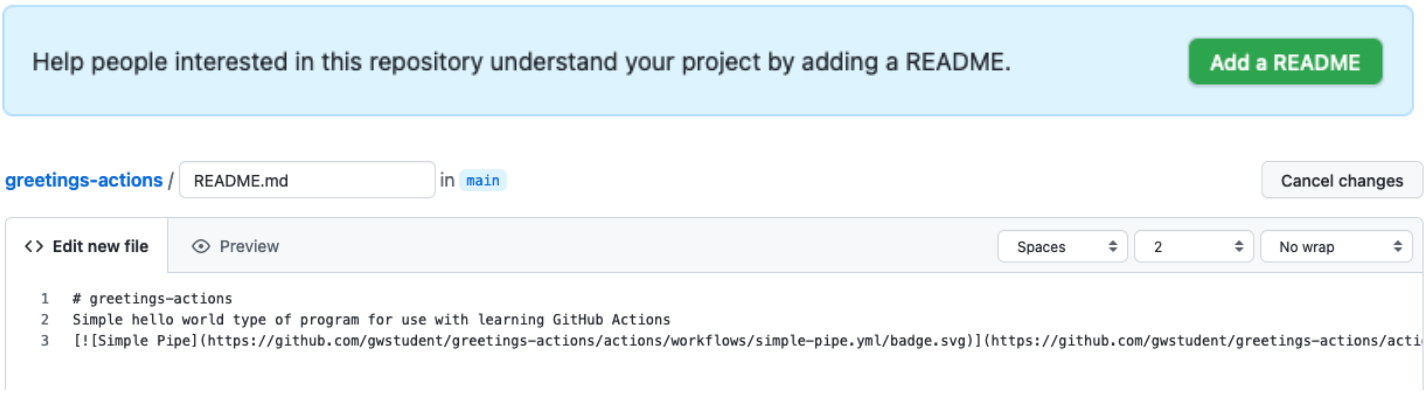


3. Select the "Simple Pipe" workflow. You'll now have a box with "..." beside the search box that has some additional options. Click on the "..." beside the search box to see some of them. They include disabling the workflow and setting up a "badge" for the workflow. Let's go ahead and set up a badge now to show success/failure for running the workflow. Click on the entry for "Create status badge".

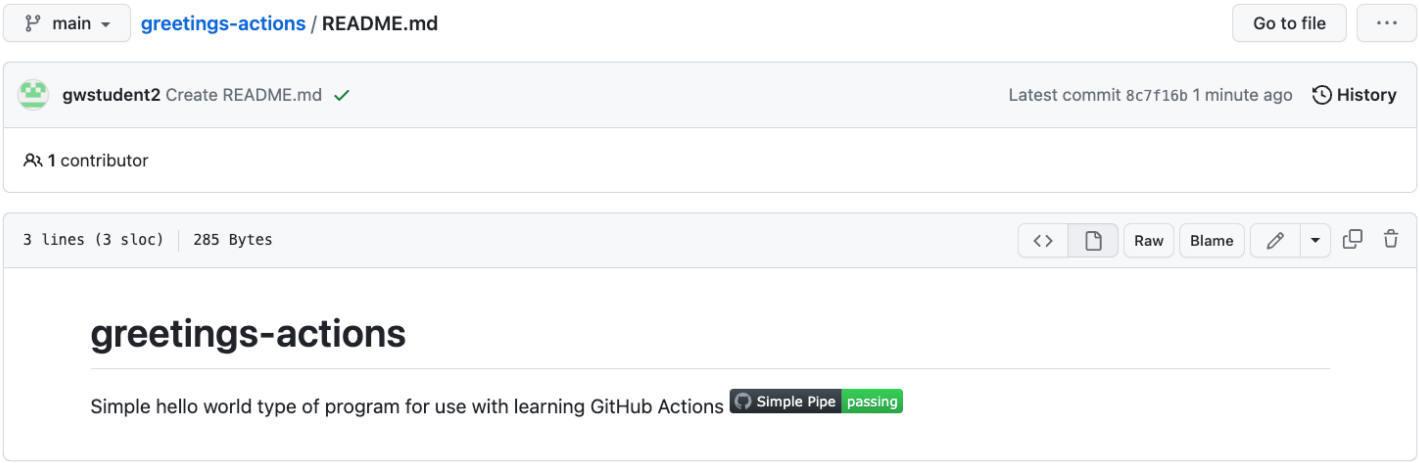
4. In the dialog that pops up, click on the entry for "Copy status badge Markdown". Then close the dialog.



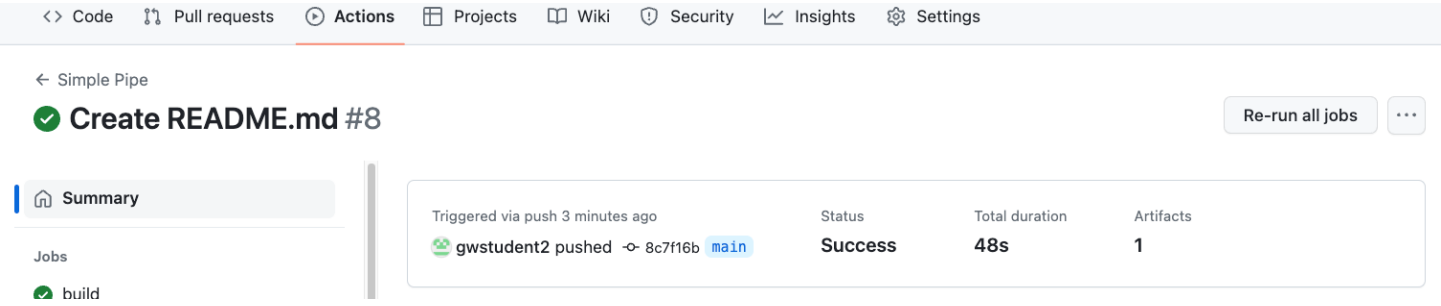
5. Click on the "<> Code" tab at the top of the project. At the bottom of the file list, click on the green button to "Add a README" (or edit the README if you already have one). Paste the code you copied in the previous step into the README.md text edit window.



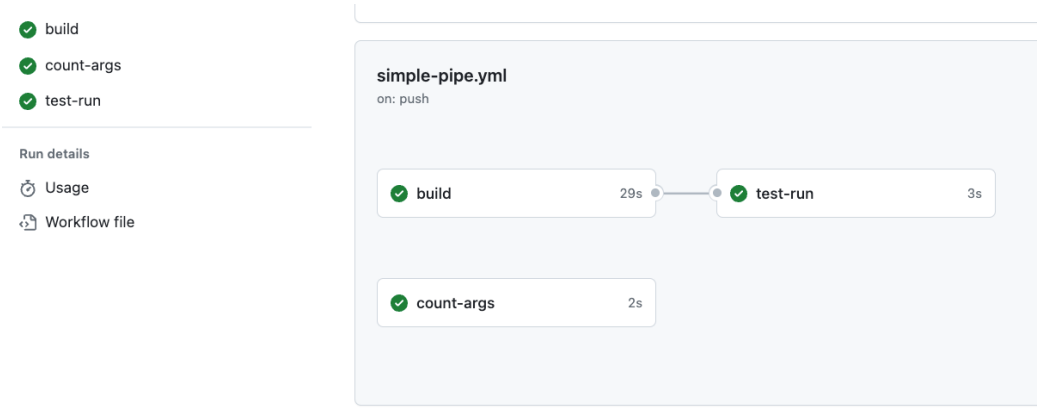
6. Scroll down and commit your changes. Then you should see the badge showing up as part of the README.md content.



7. Click back on the Actions tab. Click on the name of the top run in the Workflow runs list. Notice that we have information in the large bar at the top about who initiated the change, the SHA1, the status, duration, and number of artifacts.

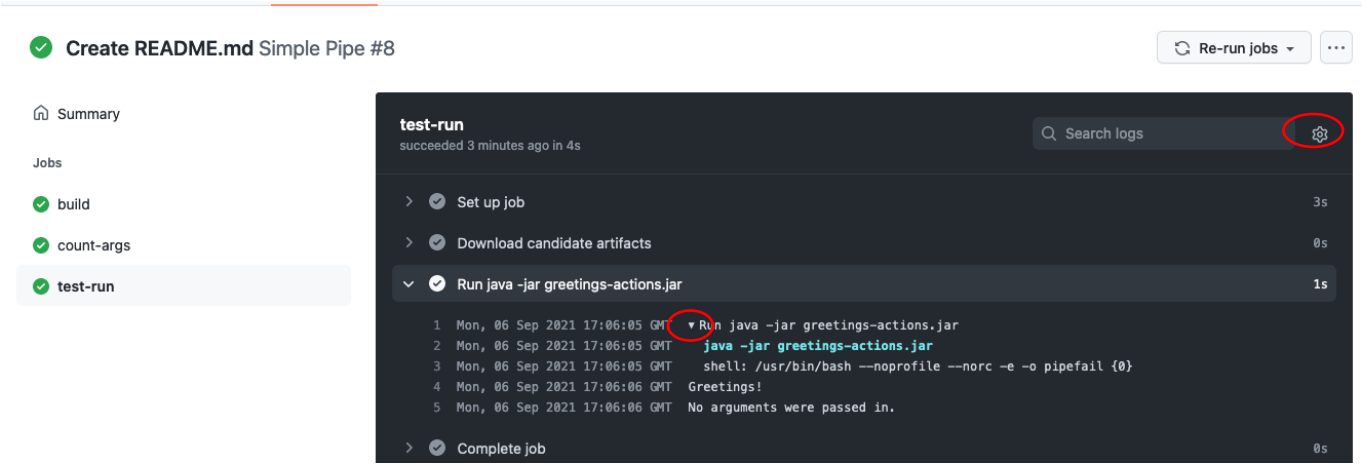


8. In the main part of the window, we have the job graph, showing the status and relationships between jobs. **Click on the "test-run" job**. In the screen that pops up, we can get more information about what happened.



First, let's turn on timestamps. **Click on the "gear" icon and select the "Show timestamps" entry.**

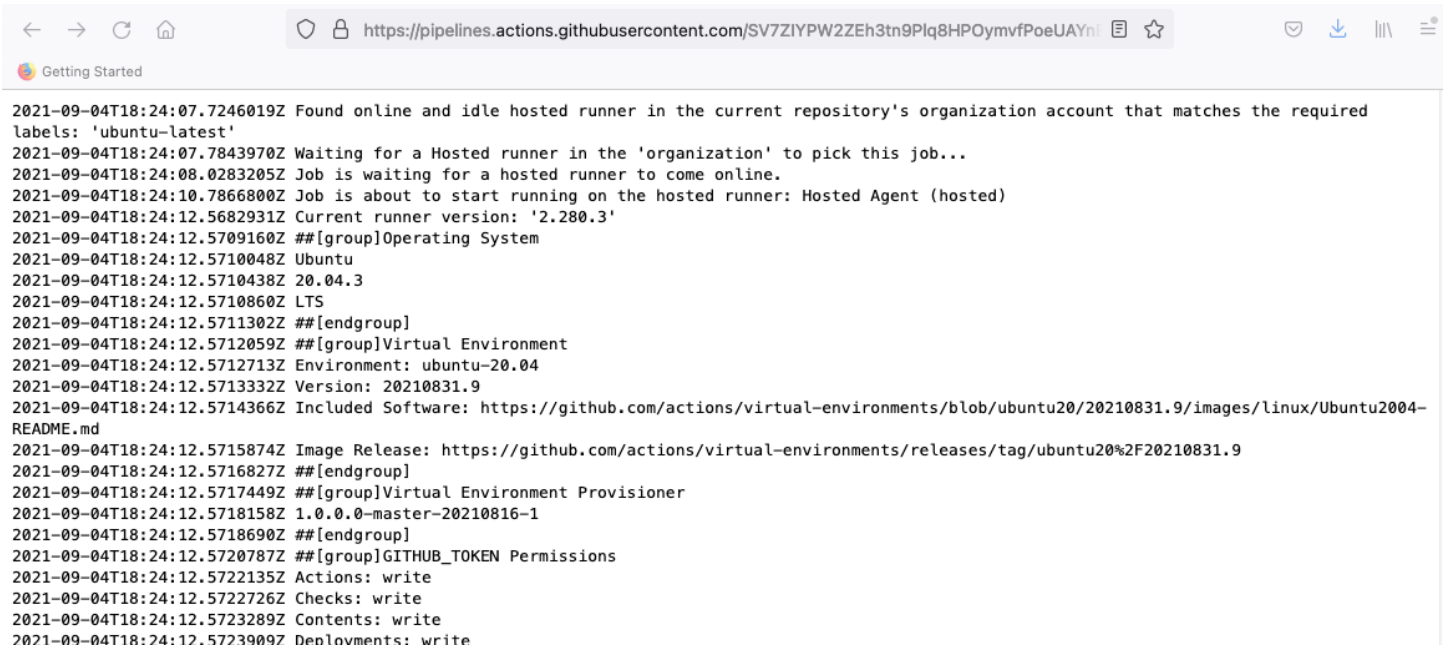
In the list of steps **click on the third item "Run java…"** to expand it. Then, in line 1 of that part, **click on the arrowhead after the timestamp** to expand the list and see all the steps executed in between.



9. We can get links to share to any line. Hover over any of the line numbers and then right-click to Copy Link, Open in a New Tab, or whatever you would like to do.

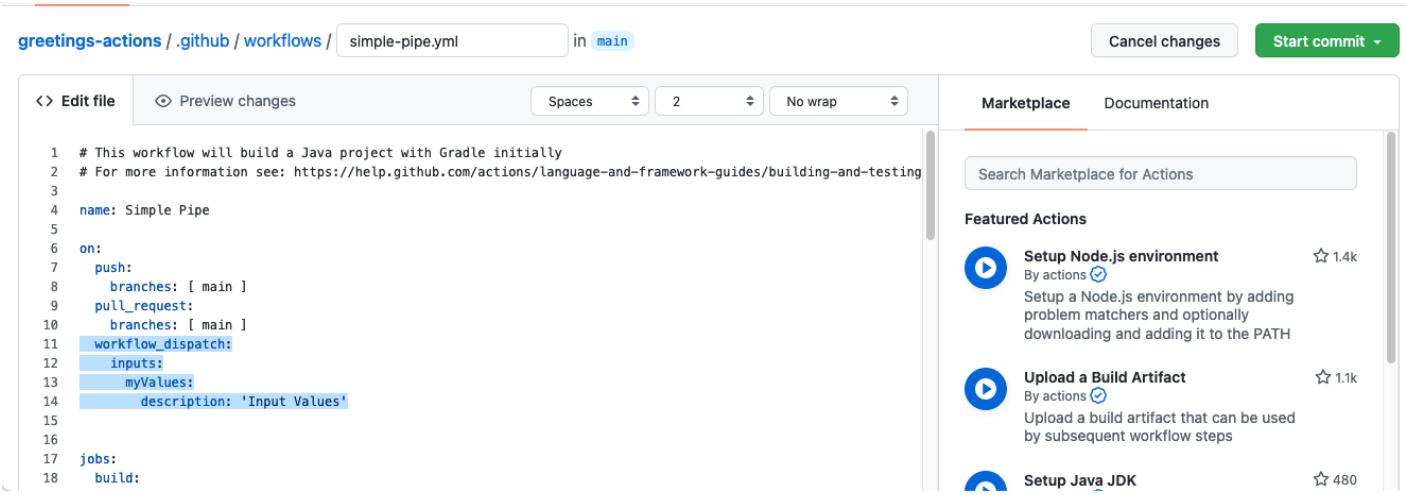
10. Click on the gear icon again. Notice there is an option to "Download log archive" if we want to get a copy of the logs locally. Or we can get a full view of the raw logs by clicking on the last entry.

    Click on "View raw logs". When you are done looking at them, switch back to the workflow screen.



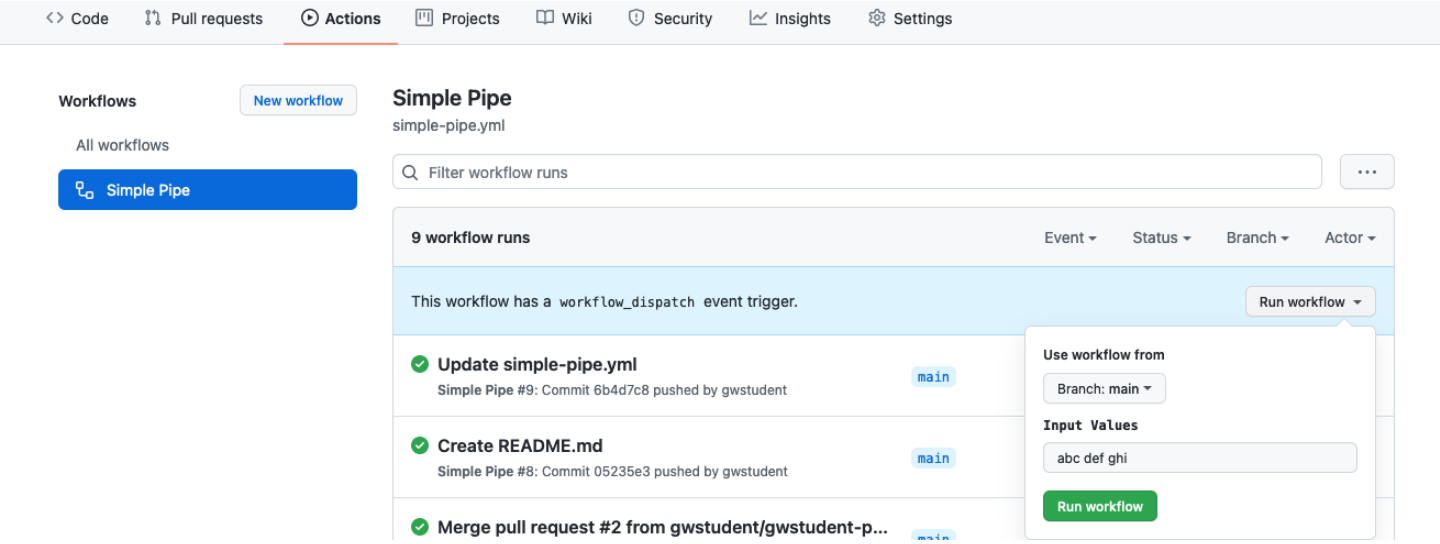
12. Let's make one more change to make it easier to run our workflow manually to try things out, start runs, etc. Edit the simple-pipe.yaml file as before. With the yaml file for the workflow open, add the code below at the bottom of the "on" section. ("workflow_dispatch" should line up with "pull" and "push")

```
workflow_dispatch:
  inputs:
    myValues:
      description: 'Input Values'
```



13. Commit your changes to the main branch. Since we added the additional "on" section, if you look at the Actions page and select the workflow and select the "Simple Pipe" workflow, you'll see that after

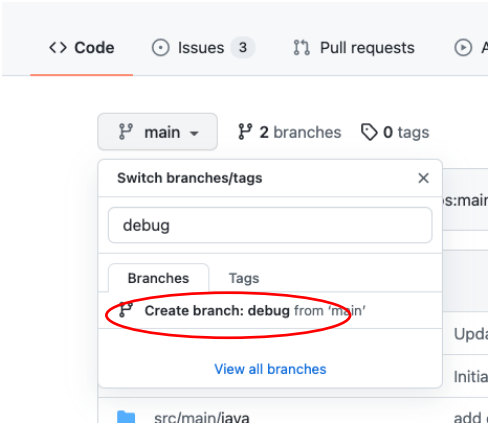
the merge we now have a note that "This workflow has a workflow_dispatch event trigger." And there is a "Run workflow" button that we can use to run the workflow manually. Click on that button, enter some data and then click "Run workflow" to see this in action. After a few moments, you should see another run of the workflow startup and complete.



Lab 5: Looking at debug info

Purpose: In this lab, we'll look at some ways to get more debugging info from our workflows.

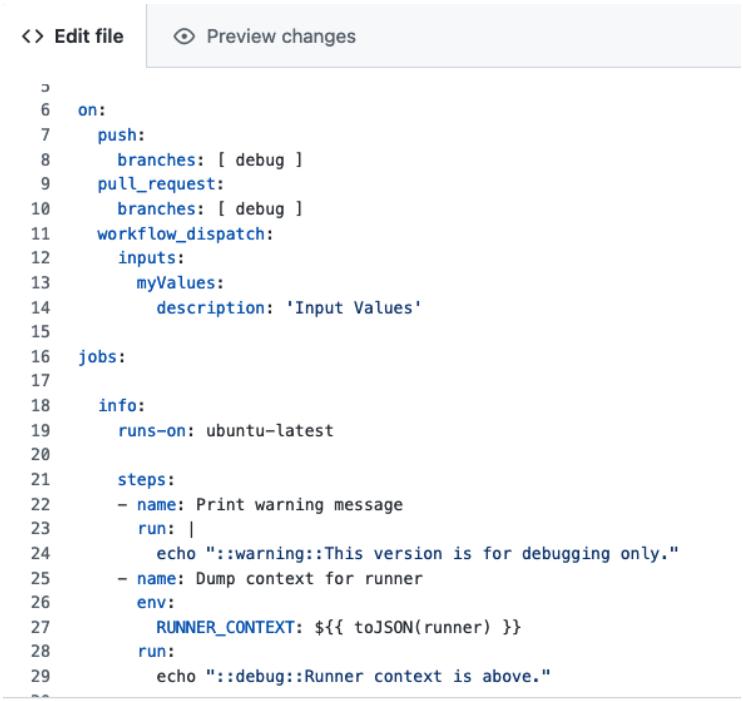
1. First, let's create a new branch in GitHub for the debug instances of our workflows. On the repository's Code page, click on the drop-down under "main", and enter "debug" in the "Find or create a branch…" field. Then click on the "Create branch: debug from 'main' link in the dialog.



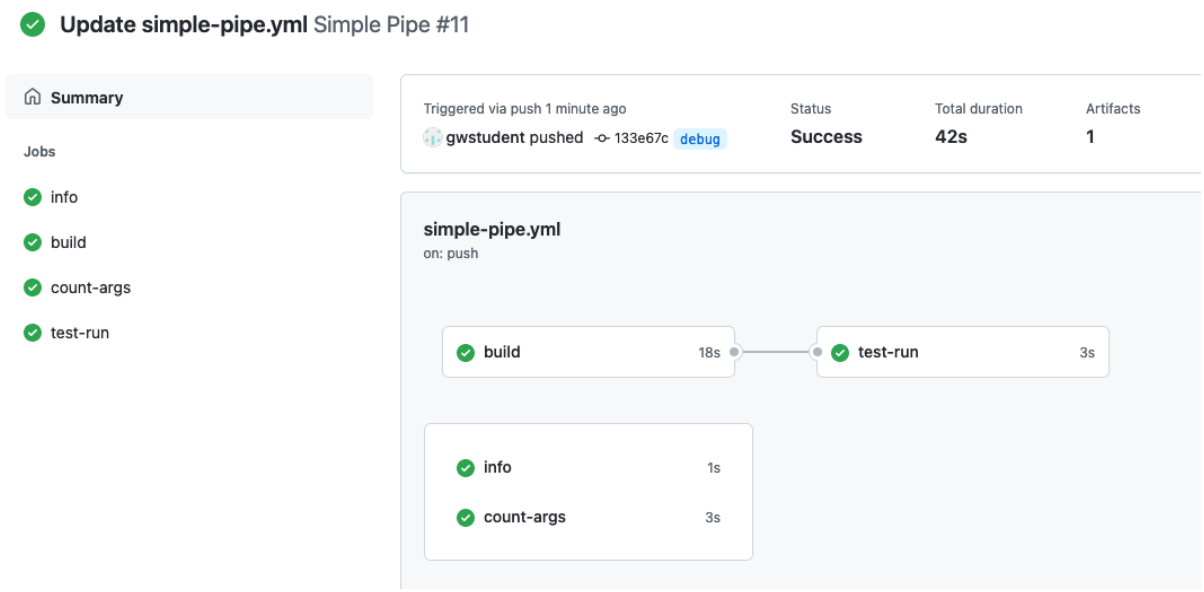
2. At this point you should be in the new branch - the "debug" branch. Go to the workflow file in .github/workflows and edit the simple-pipe.yaml file. **Change the references to "main" in the "on" section at the top to "debug".** Also, add a new job to surface some debug context.

Add in the lines below after the "jobs:" line. Pay attention to indenting again. A screenshot of how everything should look and lines up is further down. (For convenience, the text for the info job is also in a file in extra/info.txt.)

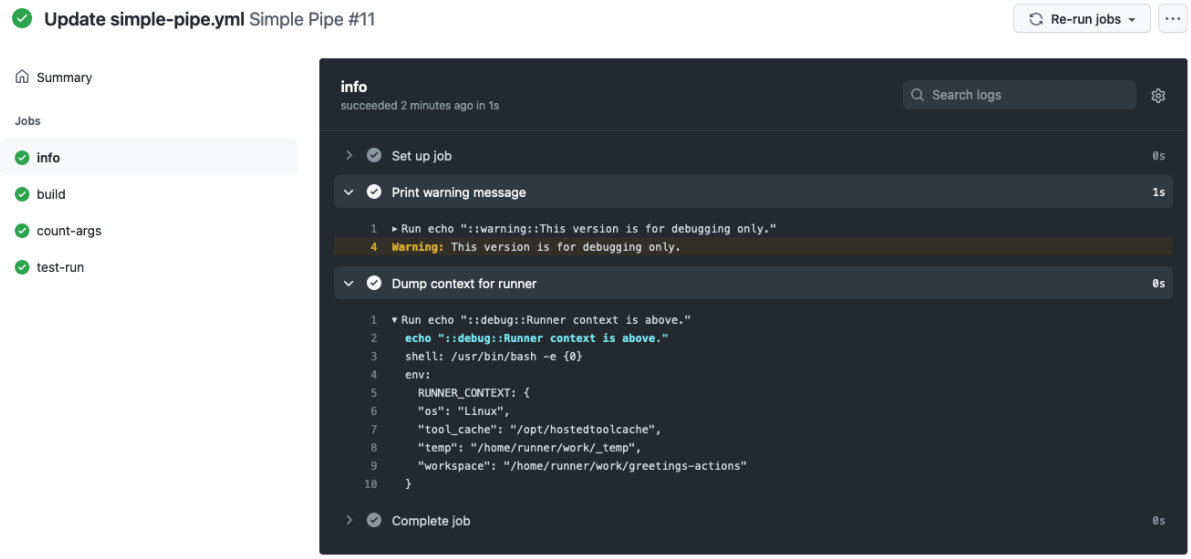
```
  info:
    runs-on: ubuntu-latest

    steps:
    - name: Print warning message
      run: |
        echo "::warning::This version is for debugging only."
    - name: Dump context for runner
      env:
        RUNNER_CONTEXT: ${{ toJSON(runner) }}
      run:
        echo "::debug::Runner context is above."
```



3. When you are done making the changes, commit as usual. Switch back to the Actions tab and click on the currently running workflow. Then click on the "info" job in the graph and look at the logs.

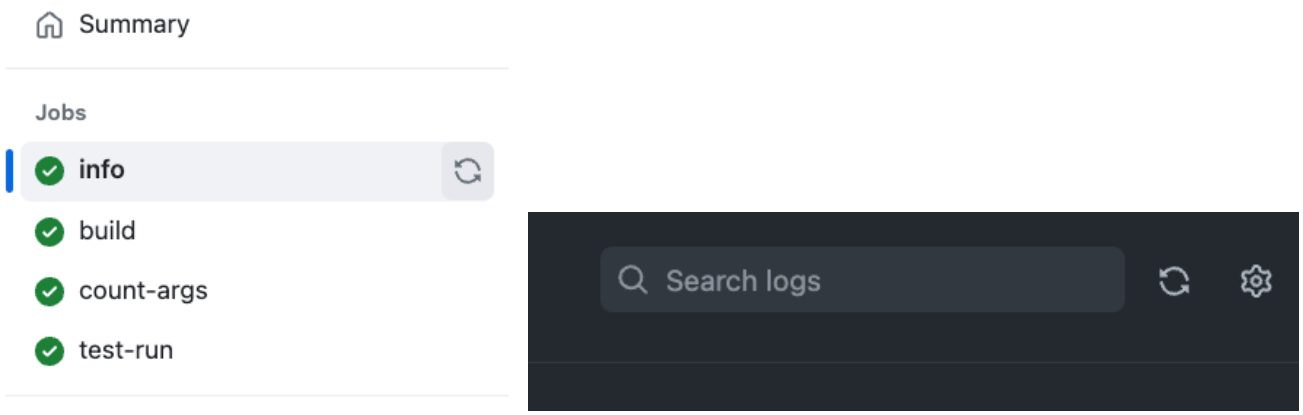


4. Expand the entries for "Print warning message" and "Dump context for runner" to see the outputs for those.

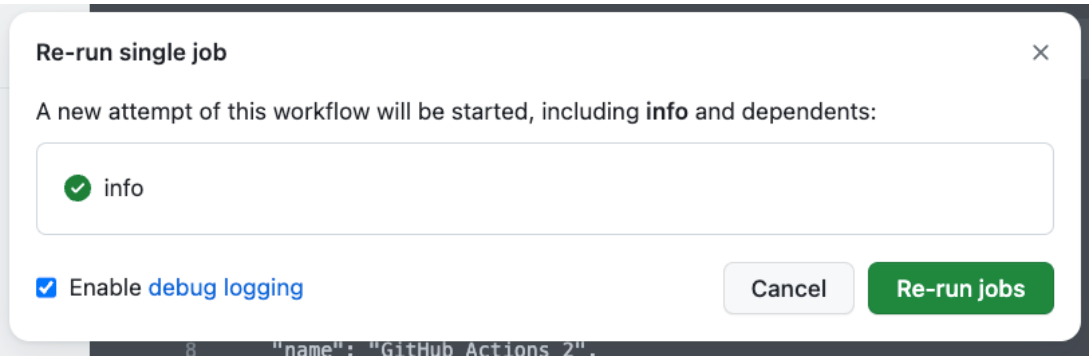


5. Notice that while we can see both commands that echo our custom "warning" and "debug" messages - only the output of the warning message actually is displayed, not the output of the debug message. There are a couple of ways to get the debugging info.

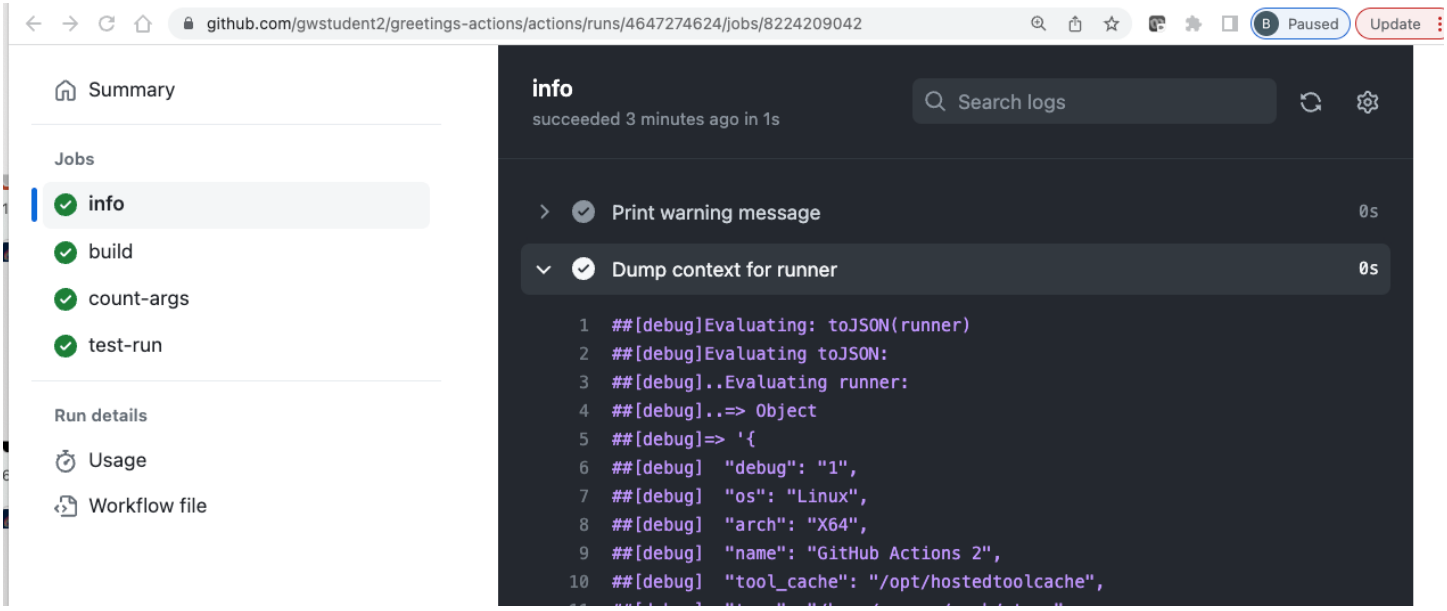
6. The first way is to simply rerun the job. If you hover over the job name under the Summary section, you can see two curved arrows appear. Click on those. (The same arrows are also available in the upper right of the logs window - next to the gear icon.)



7. This will bring up a dialog to re-run that job (and any dependent jobs) - with a checkbox to click to *Enable debug logging*. Click that box and and then click the "Re-run jobs" button.

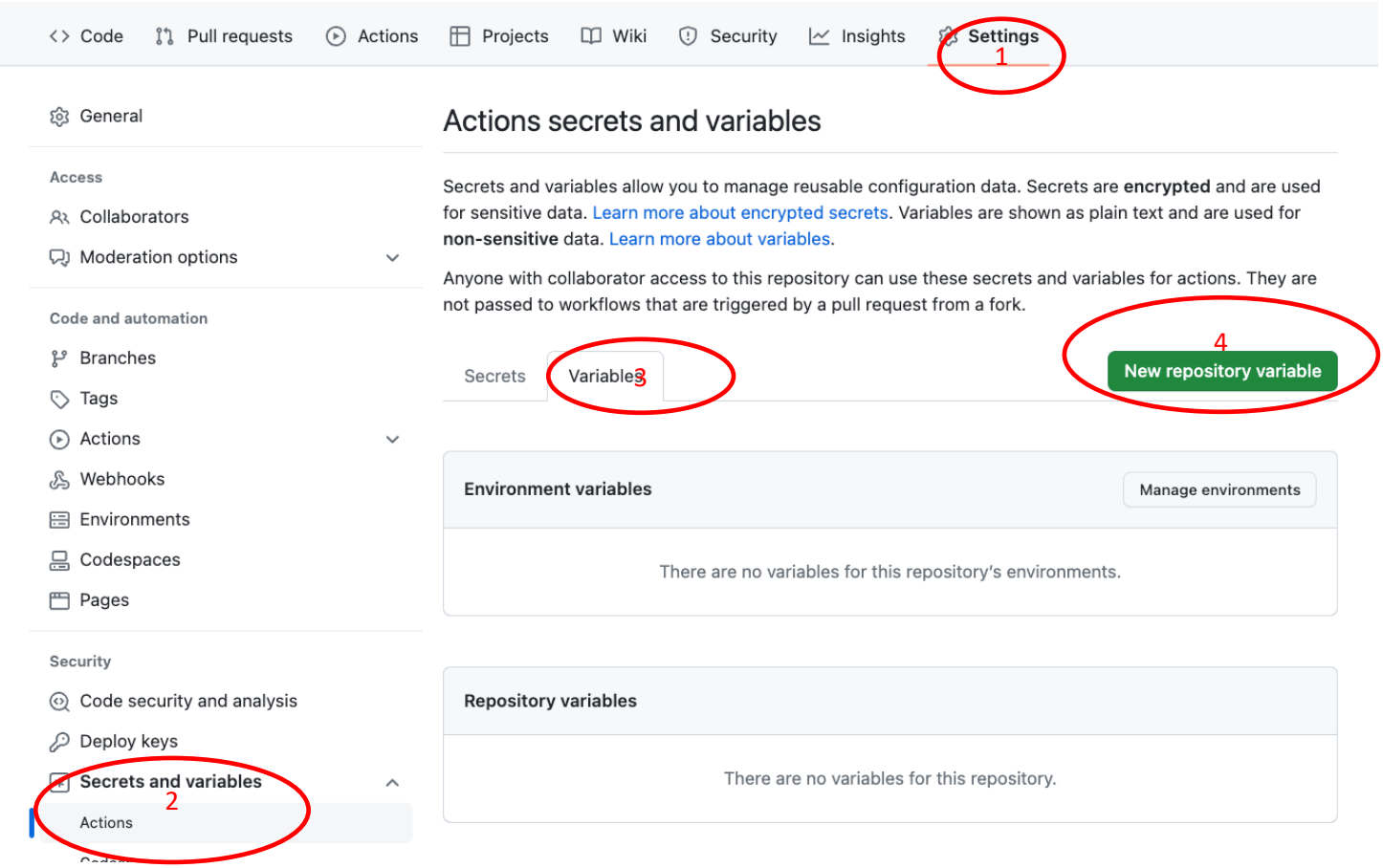


8. After the job is re-run, if you look at the latest output, and expand the "Dump context for runner" step, you'll see the actual debug output.

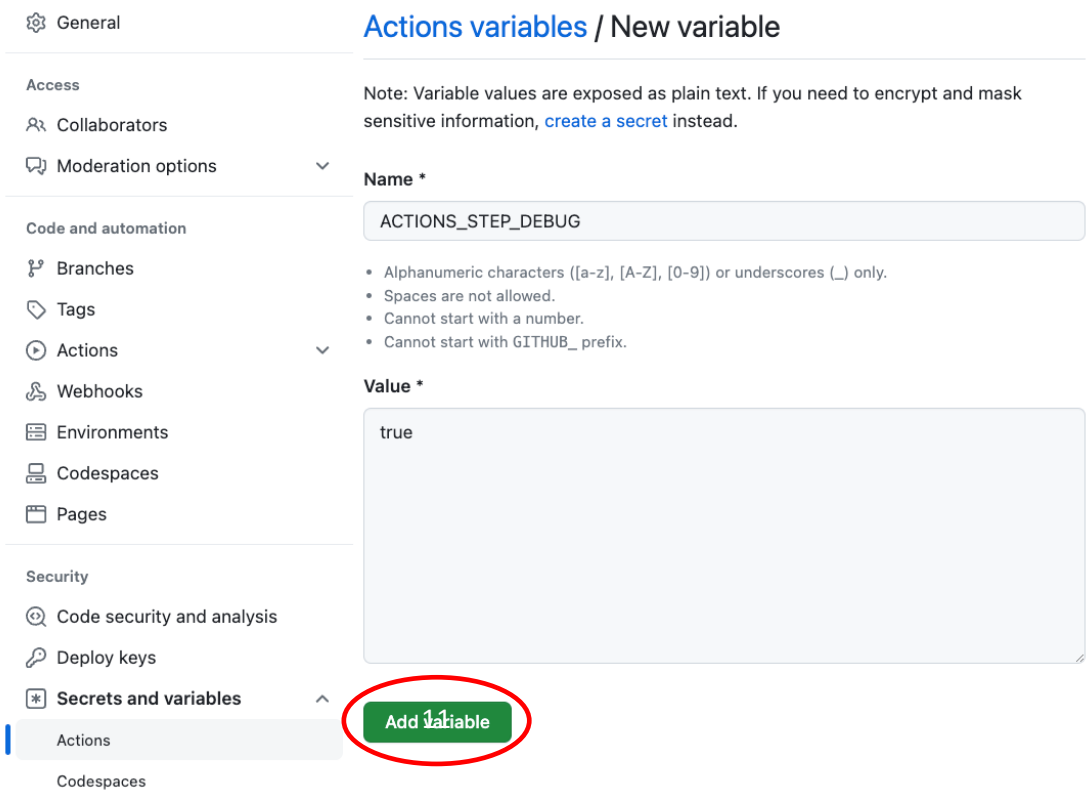


9. However, that doesn't cause debug info to show up for commits. We do that by enabling a secret or a variable for ACTIONS_STEP_DEBUG. Since this setting is not sensitive information, we'll use a variable.

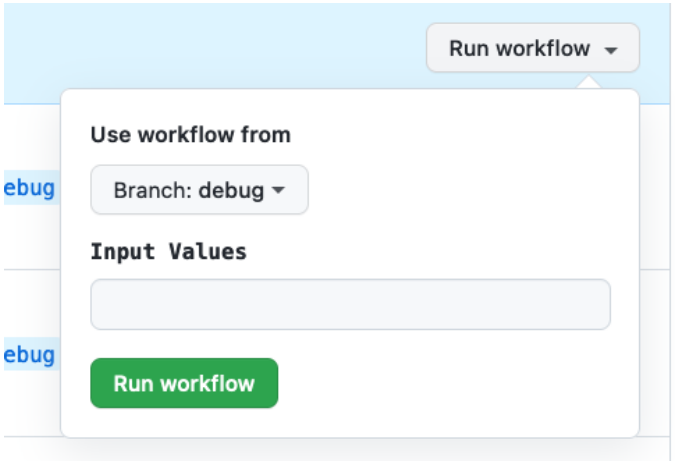
10. To do this, go to the repository's top menu and select "Settings". Then on the left-hand side, select "Secrets and variables", and then "Actions" under that. Select the "Variables" tab and "New repository variable". Underneath "Secrets", click on "Actions". Now, click on the "New repository secret" in the upper right to create a new secret for the action to use.



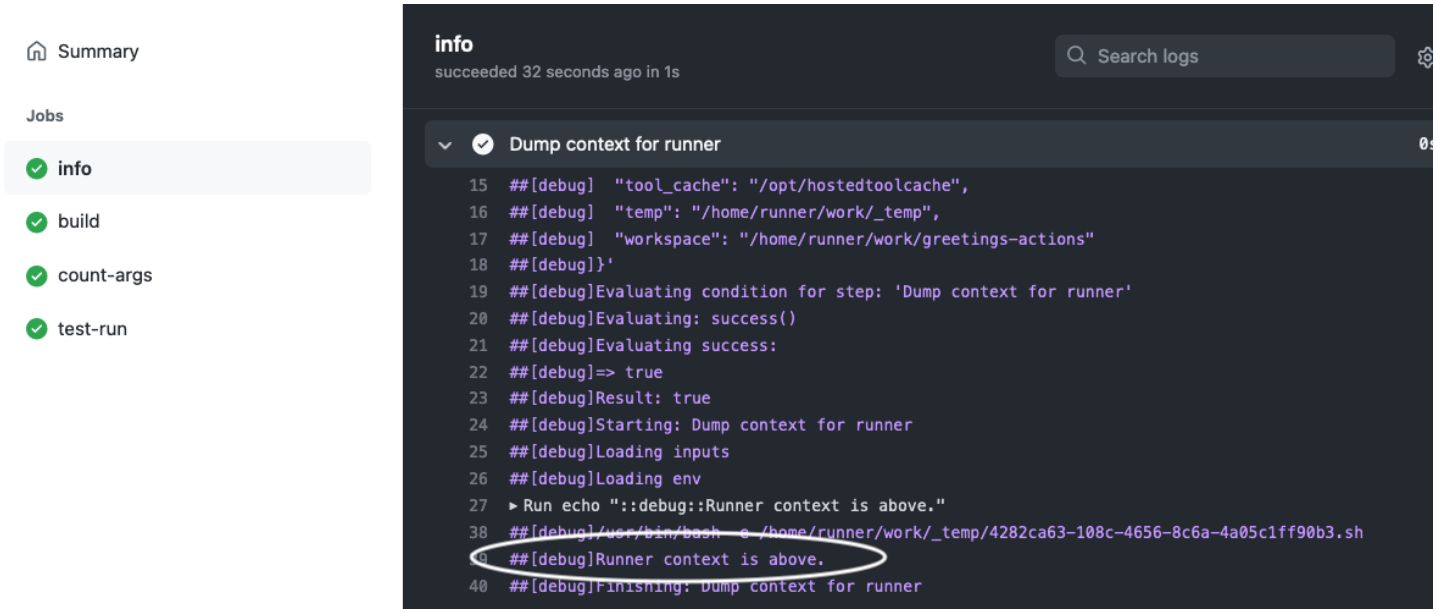
11. On the next screen, enter **ACTIONS_STEP_DEBUG** for the name, set the value to *true* and click on the *Add variable* button.



12. Now, switch back to the "Actions" tab, select the "Simple Pipe" workflow, and click on the "Run workflow" button. **Select "debug" from the list for the branch.** Enter in any desired arguments. Then click the green "Run workflow" button to execute the workflow.



13. A new run will be started. Go into it and select the "info" job. In the output now, if you expand the sections, you should be able to see a lot of "##[debug]" messages including the one you added in the "Dump context for runner" section.



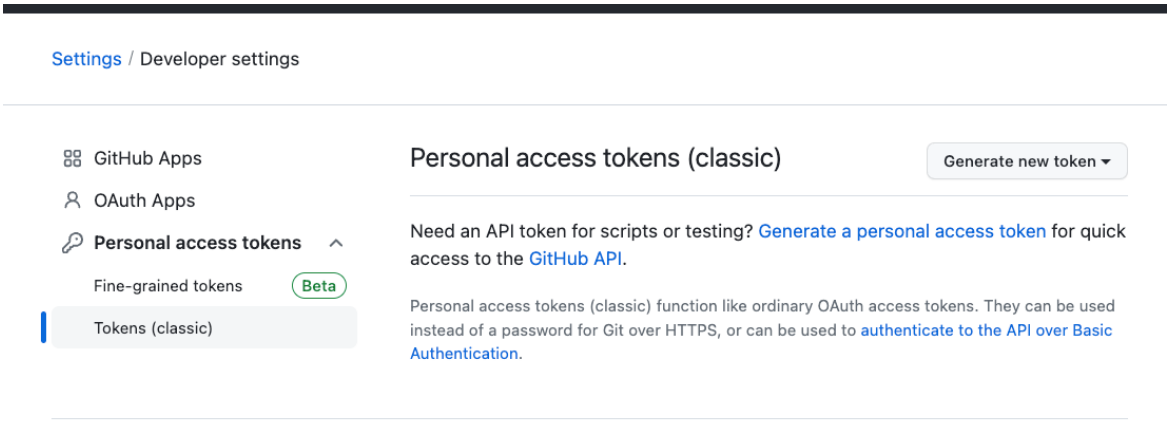
14. Note that the debug log info will be turned on for all runs from here on - as long as the repository variable exists and is set to "true".

Lab 6: Chaining workflows, using conditionals, and working with REST APIs in workflows.

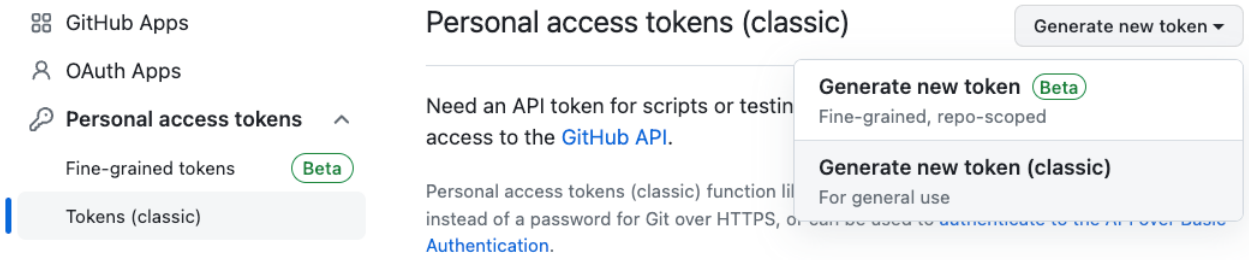
Purpose: Learning one way to drive one workflow from another.

1. For this lab, we need to prepare a Personal Access Token (PAT) and add it to a secret that our workflow can reference. If you already have a PAT, you may be able to use it if it has access to the project. If not, you'll need to create a new one. Go to https://github.com/settings/tokens.

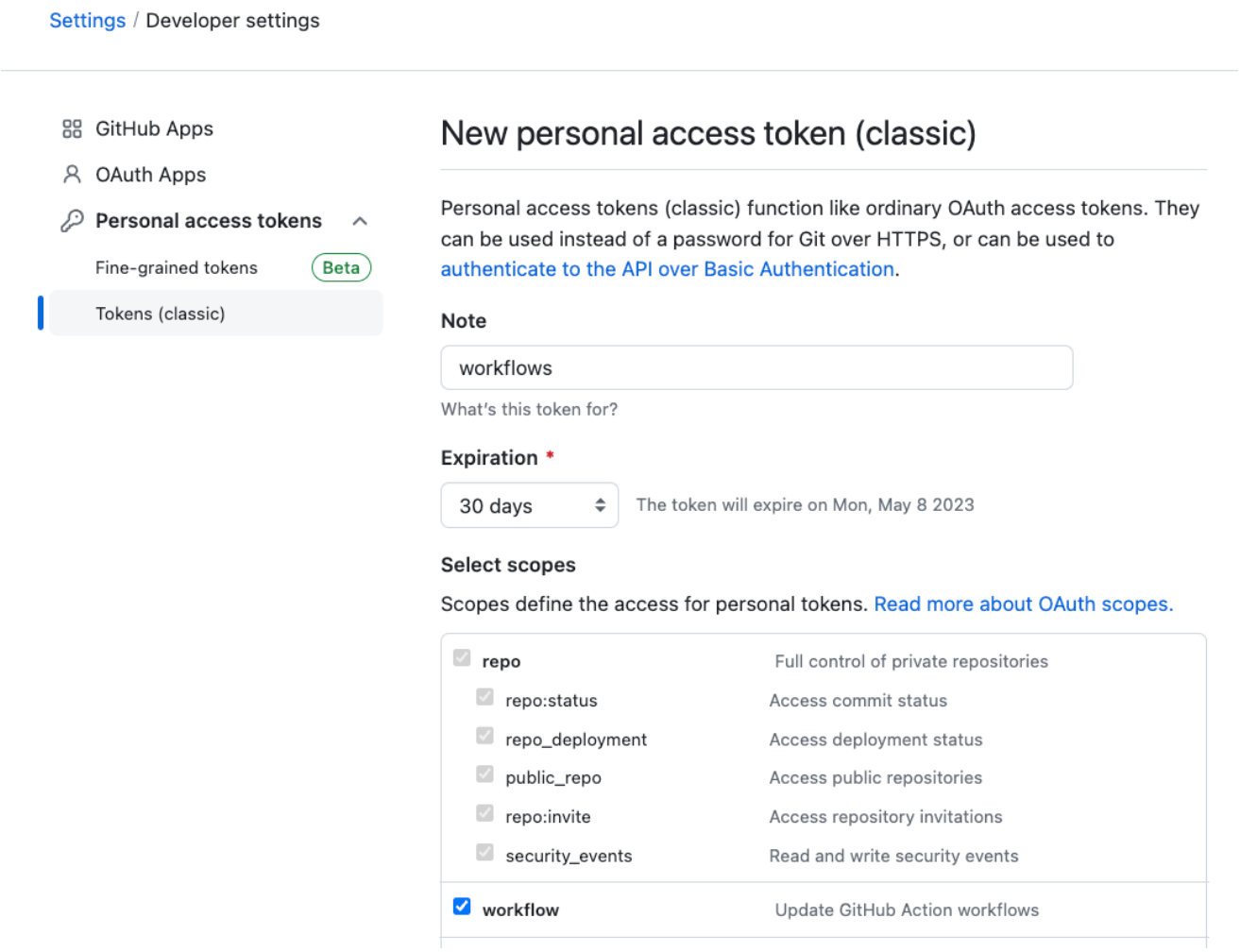
   (Alternatively, on the GitHub repo screen, click on your profile picture in the upper right, then select "Settings" from the drop-down menu. You should be on the https://github.com/settings/profile screen. On this page on the left-hand side, select "Developer settings" near the bottom. On the next page, select "Personal access tokens", then "Tokens (classic)".)



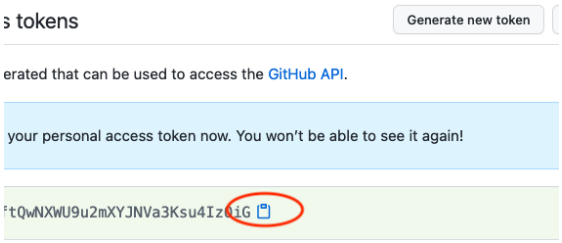
2. In the upper right, click on "Generate new token". You can just use the "classic" token, so click on the "Generate new token (classic)" selection if needed. Confirm your password if prompted.



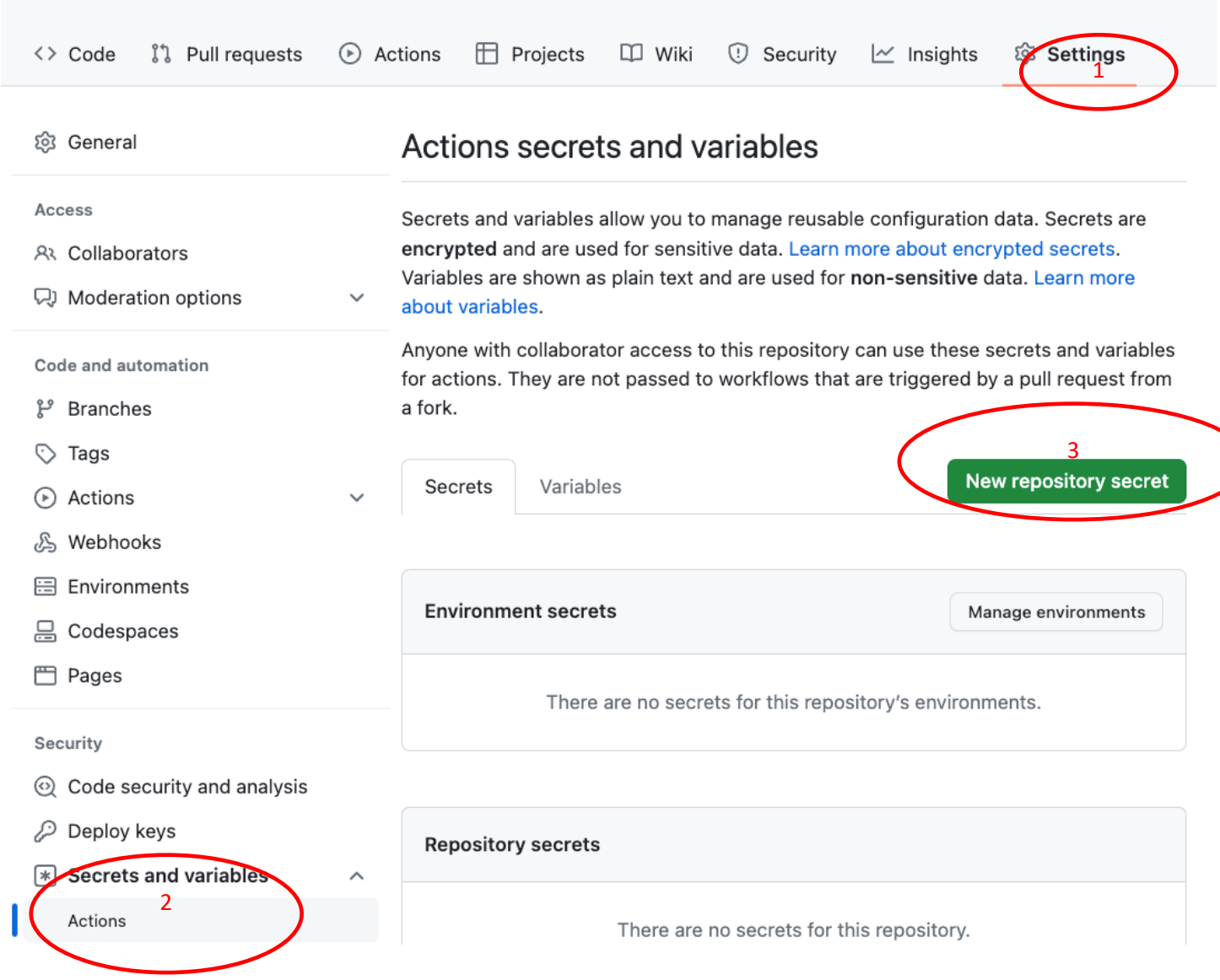
3. Enter whatever text you want in the "Note" section. Confirm your password if asked. In the "Note" section enter some text, such as "workflows". You can set the "Expiration" time as desired or leave it as-is. Under "Select scopes", assuming your repository is public, you can just check the boxes for "repo" and "workflow". Then click on the green "Generate token" at the bottom.



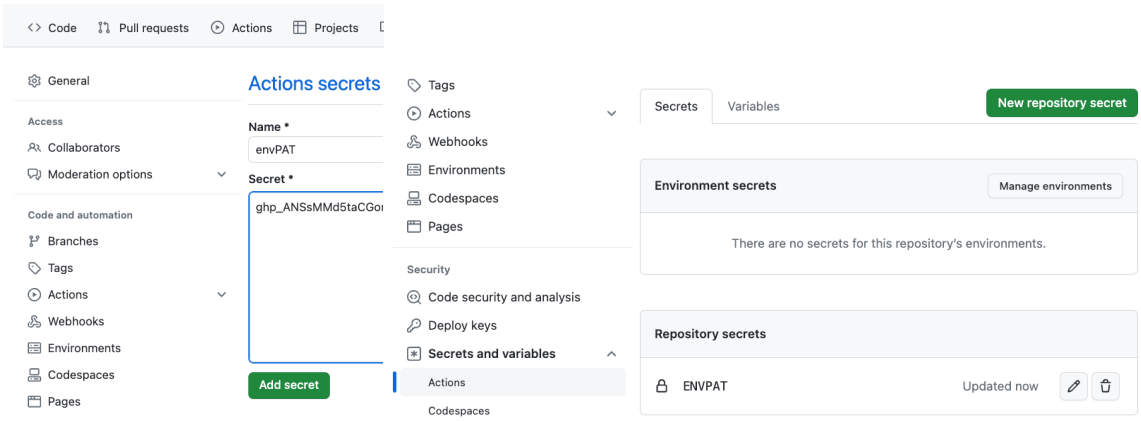
4. After the screen comes up that shows your new token, make sure to copy it and store it somewhere you can get to it for future steps.



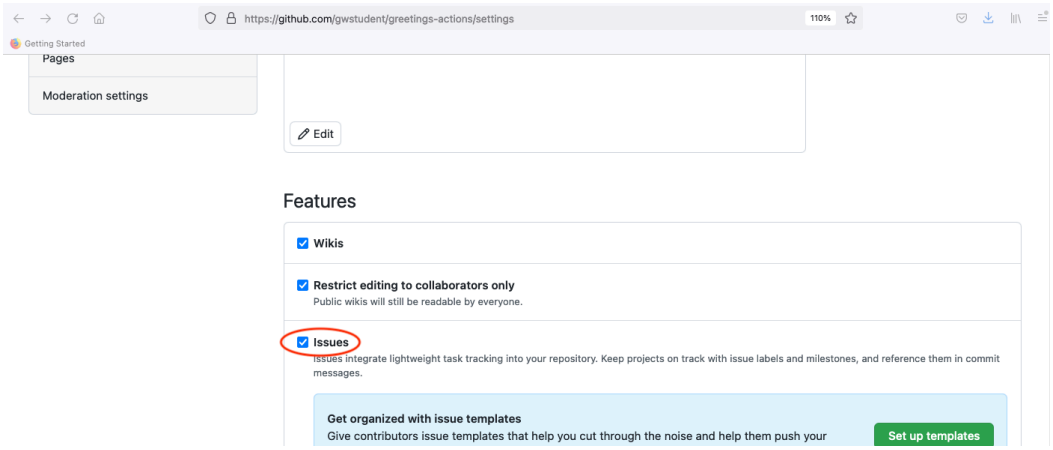
5. Now we'll create a new secret and store the PAT value in it. Go back to the repository (not your personal account) and select "Settings" from the top menu. Then on the left-hand side, select "Secrets and variables" and then "Actions". Now, click on the "New repository secret" button in the middle right to create a new secret for the workflow to use.



6. For the *Name* of the new secret, use *envPAT*. Paste the value from the PAT into the *Value* section. Then click on the "Add secret" button at the bottom. After this, the new secret should show up in the list of repository secrets.



7. We're going to create a new workflow that will be able to automatically create a GitHub issue in our repository. And then we will invoke that workflow from our current workflow. But first, we need to ensure that the "Issues" functionality is turned on for this repository. Go to the project's Settings main page, scroll down and under "Features", make sure the "Issues" selection is checked.

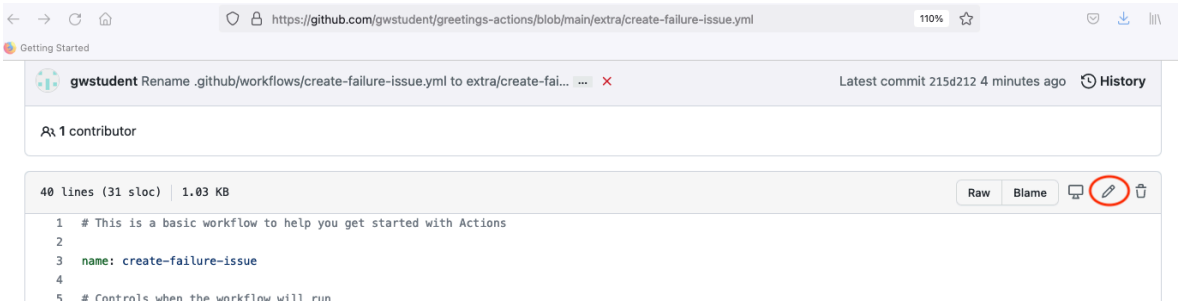


8. The workflow to create the issue using a REST API call is already written to save time. It is in the main project under "extra/create-failure-issue.yml". You need to get this file in the .github/workflows directory. You can just move it via GitHub with the following steps.

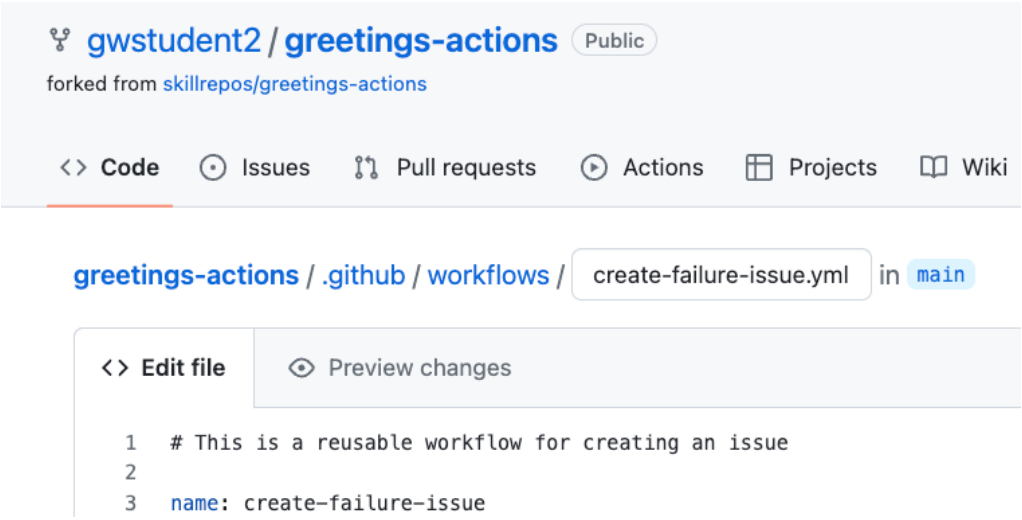
    a. In the repository, browse to the "extra" folder and to the "create-failure-issue.yml" file.
    b. Take a few moments to look over the file and see what it does. Notice that:
        i. It has a workflow_call section in the "on" area, which means it can be run from another workflow.
        ii. It has a workflow_dispatch section in the "on" area, which means it can be run manually.

iii. It has two inputs - a title and body for the issue.
iv. The primary part of the body is simply a REST call (using the GITHUB_TOKEN) to create a new issue.

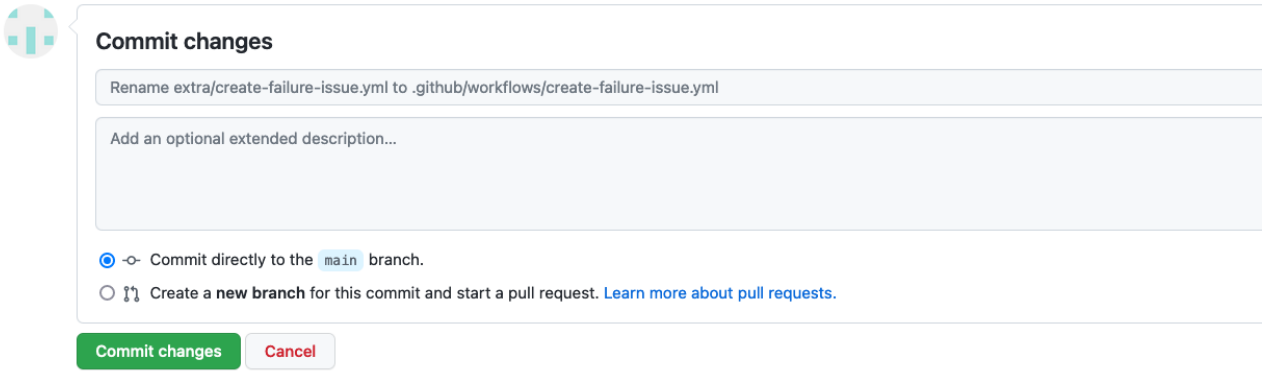
c. Click the pencil icon to edit it.



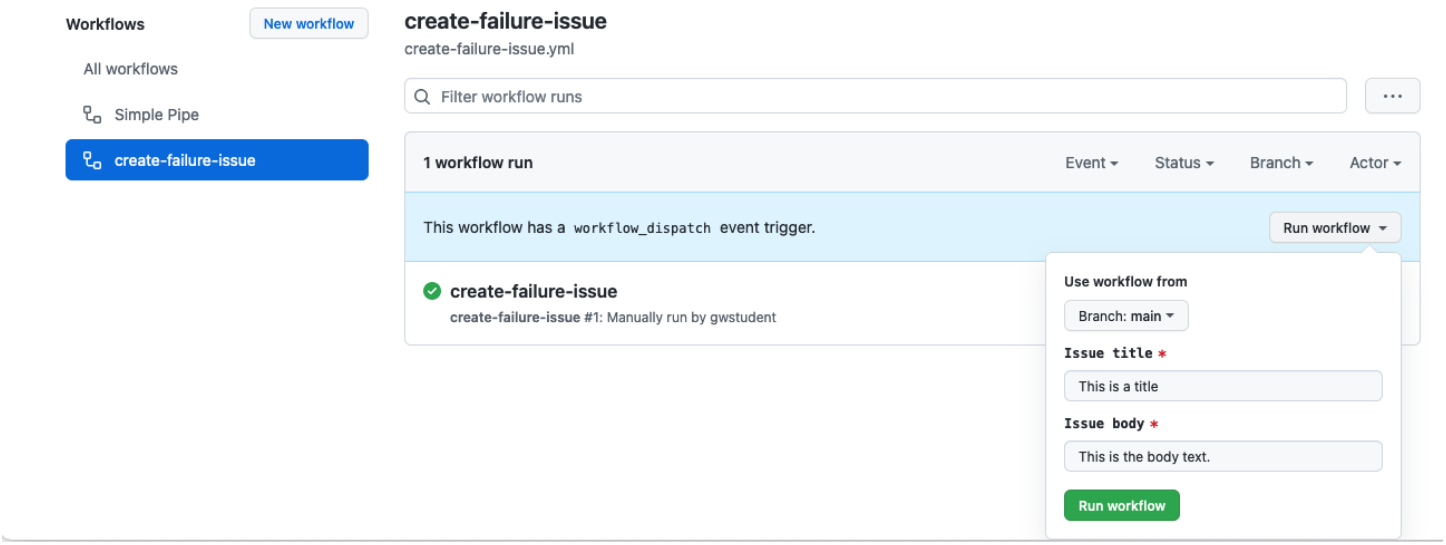
d. In the filename field at the top, change the name of file. Use the backspace key to backspace over "extra/" making sure to backspace over the word. Then type in the path to put it in the workflows ".github/workflows/create-failure-issue.yml".



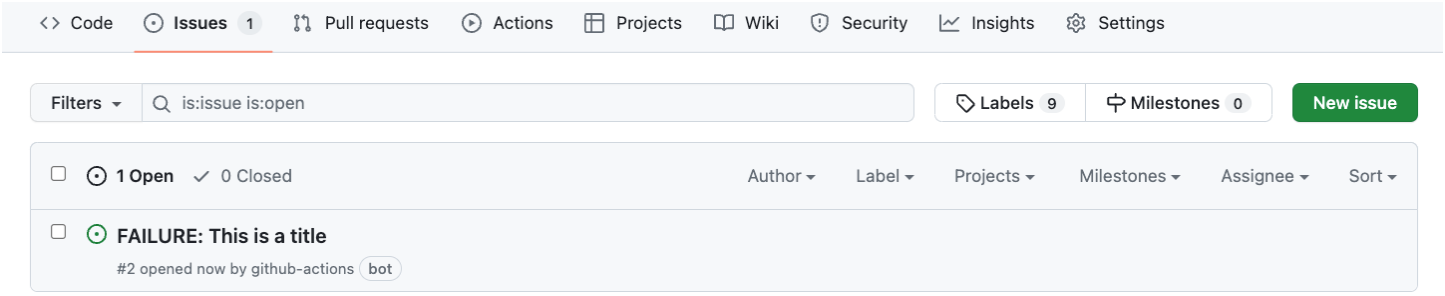
e. To complete the change, scroll to the bottom of the page, and click on the green "Commit changes" button.



9. Go back to the Actions tab. You'll see a new workflow execution due to the rename. Also, in the Workflows section on the left, you should now see a new workflow titled "create-failure-issue". Click on that. Since it has a workflow_dispatch event trigger available, we can try it out. Click on the "Run workflow" button and enter in some text for the "title" and "body" fields. Then click "Run workflow".



10. After a moment, you should see the workflow run start and then complete. If you now click on the Issues tab at the top, you should see your new issue there.



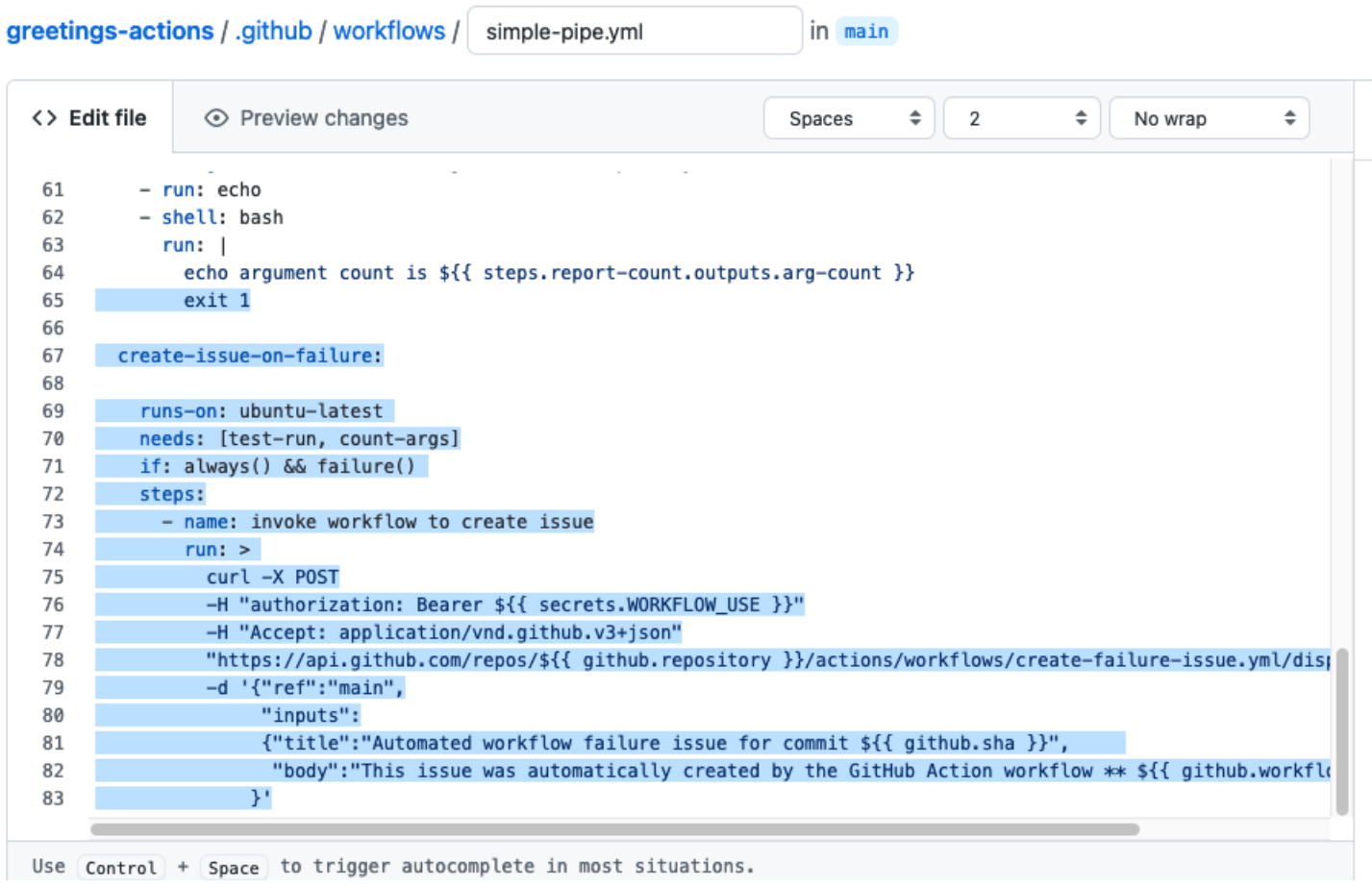
11. Now that we know that our new workflow works as expected, we can make the changes to the previous workflow to "call" this if we fail. Edit the simple-pipe.yml file and add the following lines as a new job and set of steps at the end of the workflow. (For convenience, these lines are also in the file "extra/create-issue-on-failure.txt" if you want to copy and paste from there.)

```
  create-issue-on-failure:

    runs-on: ubuntu-latest
    needs: [test-run, count-args]
    if: always() && failure()
    steps:
      - name: invoke workflow to create issue
        run: >
```

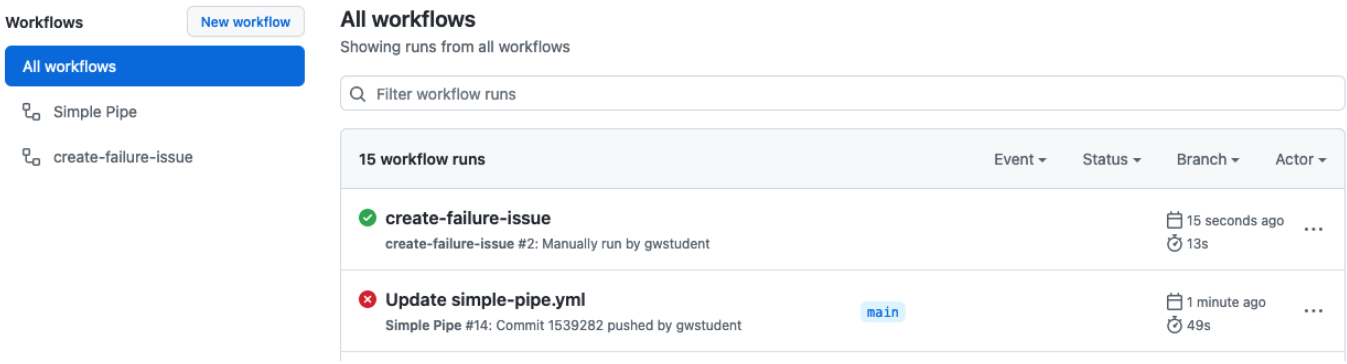
```
          curl -X POST
          -H "authorization: Bearer ${{ secrets.WORKFLOW_USE }}"
          -H "Accept: application/vnd.github.v3+json"
          "https://api.github.com/repos/${{ github.repository }}/actions/workflows/create-
failure-issue.yml/dispatches"
          -d '{"ref":"main",
               "inputs":
               {"title":"Automated workflow failure issue for commit ${{ github.sha }}",
                "body":"This issue was automatically created by the GitHub Action workflow
** ${{ github.workflow }} **"}
              }'
```

12. In order to have this executed via the "if" statement, we need to force a failure. We can do that by simply adding an "exit 1" line at the end of the "count-args" job (right above the job you just added).

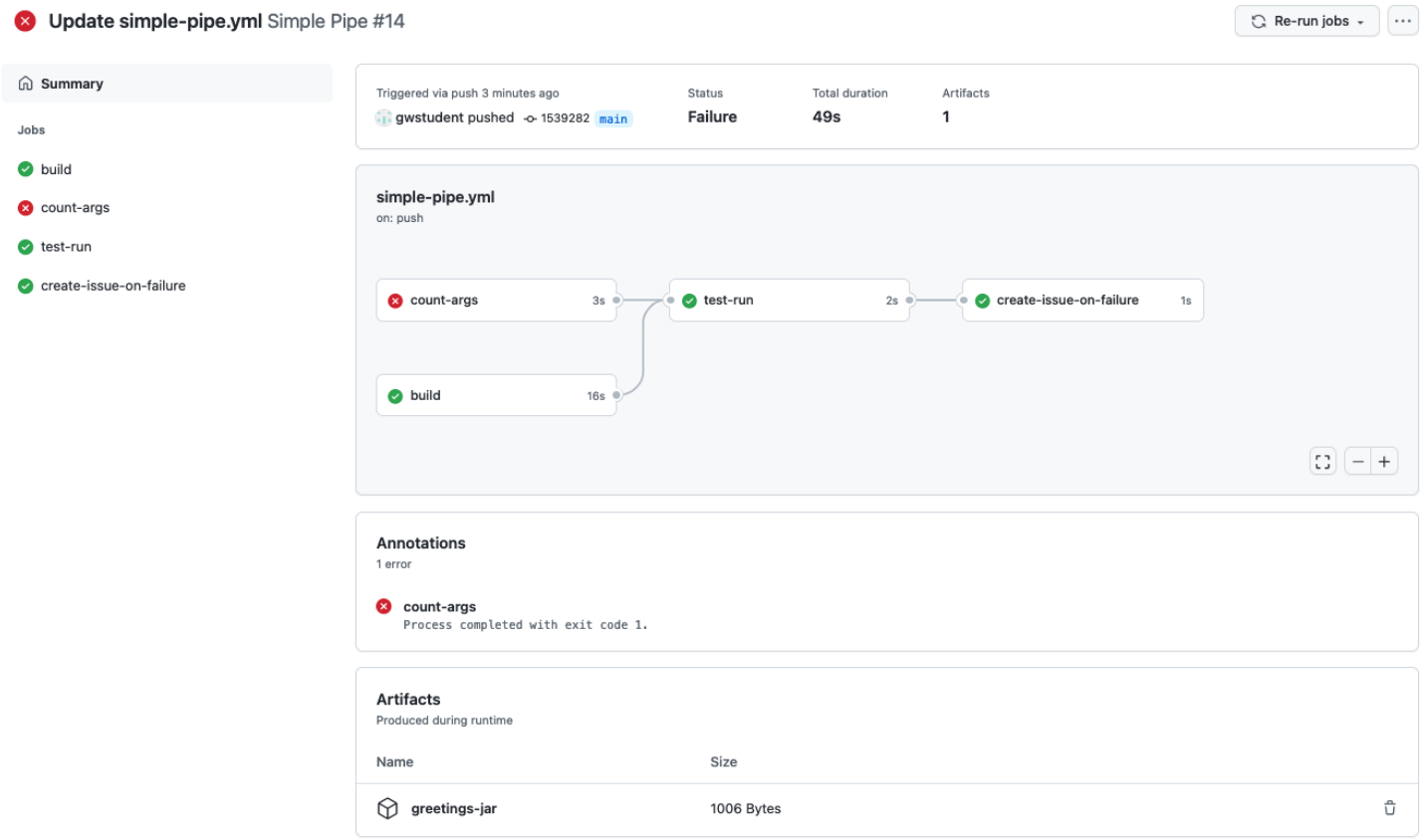
    Make that change too. (A screenshot is below showing what the changes should look like. The "exit 1" is line 65 in the figure.)

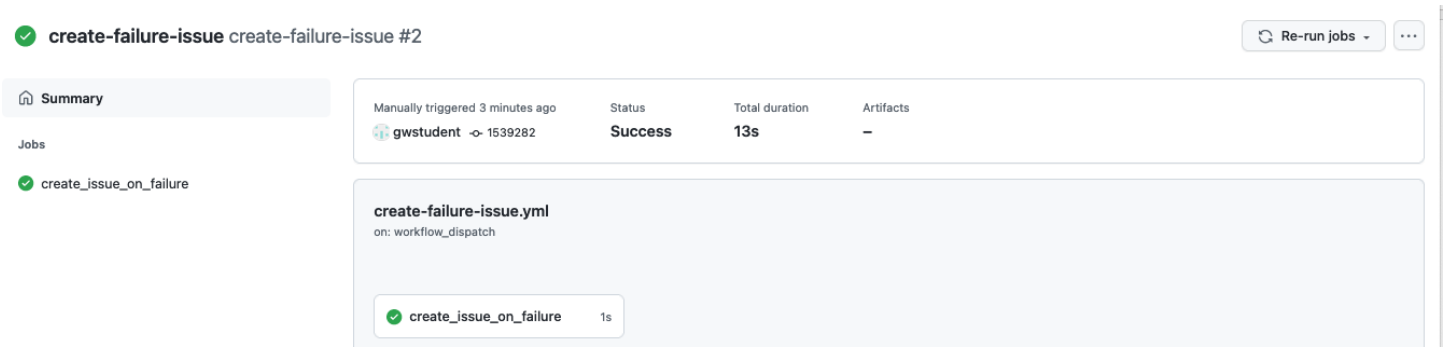


13. After you've made the changes, commit them. At that point, you should get a run of the workflow. Click back to the Actions tab to watch it. After a few minutes, it will complete, and the "count-args" job will fail. This is expected because of the "exit 1" we added. But in a few moments, the create-issue-on-failure job should kick in and invoke the other workflow and produce a new ticket.

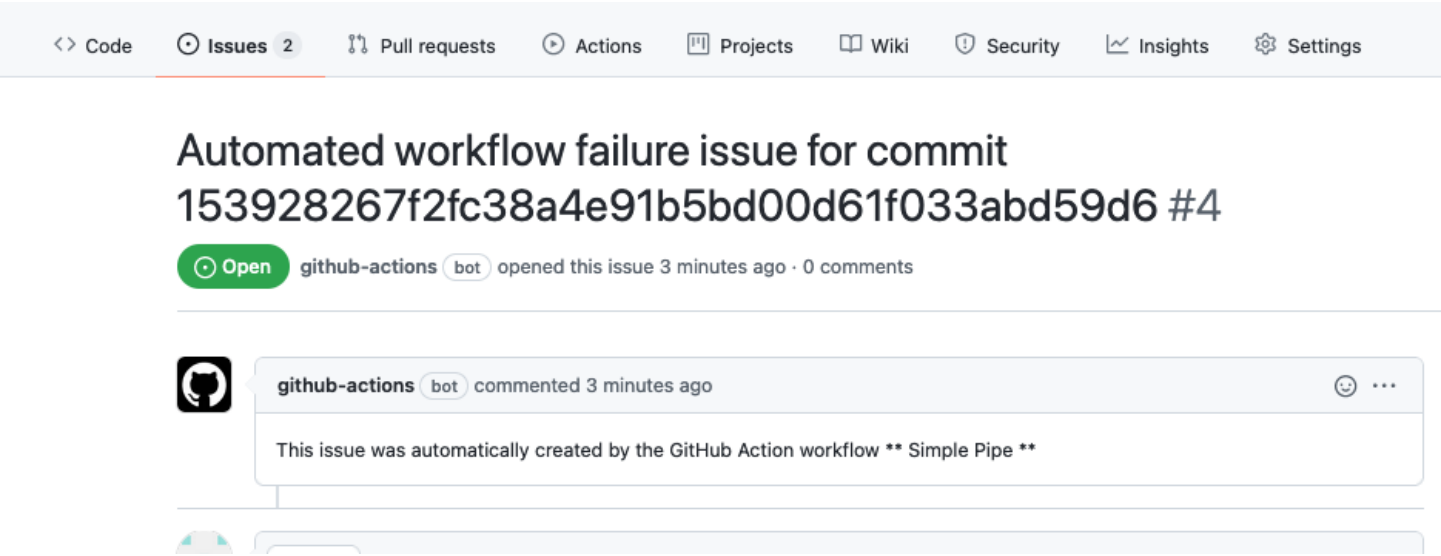


You can look at the graphs from the runs of the two workflows if you want.





14. Under "Issues", you can also see the new ticket that was opened with the text sent to it.



THE END - THANKS!