# Assignment 3: RSS Feed Filter

*Weightage:* ***6%***

**Deadline:** Friday 5th December 2025, **11:59 PM**

## Introduction

You will use object-oriented programming *(classes and inheritance)* to build a program to monitor news feeds over the Internet. Your program will filter the news, alerting the user when it notices a news story that matches that user's interests *(for example, the user may be interested in a notification whenever a story related to the F1 race is posted).*

### Getting Started

#### Download and Save

`a3_starter.zip`: A zip file of all the files you need, including:

- `a3.py`: a skeleton for you to fill in and ultimately submit
- `a3_test.py`: a test suite that will help you check your answers
- `triggers.txt`: a trigger configuration file
- `feedparser.py`: a module that will retrieve and parse feeds for you
- `project_util.py`: a module that converts simple HTML fragments to plain text
- `mtTkinter.py`: a module that handles graphic interface

The three modules (`feedparser.py`, `project_util.py`, `mtTkinter.py`) are necessary for this problem set to work, but you will not need to modify or understand them.

## RSS Feed Filter

### RSS Overview

News sites, such as Google News, have content that is updated on an unpredictable schedule. One tedious way to keep track of this changing content is to load the website up in your browser and periodically hit the refresh button.

Fortunately, this process can be streamlined and automated by connecting to the website's RSS feed, using an RSS feed reader instead of a web browser. An RSS reader *(e.g. Feedly or FreshRSS)* will periodically collect and draw your attention to updated content.

RSS stands for *"Really Simple Syndication"*. An RSS feed consists of *(periodically changing)* data stored in an XML-format file residing on a web-server. For this problem set, the details are unimportant. You don't need to know what XML is, nor do you need to know how to access these files over the network. We have taken care of retrieving and parsing the XML file for you.

## Data Structure Design

### RSS Feed Structure: Google News

First, let's talk about one specific RSS feed: Google News. The URL for the Google News feed is: http://news.google.com/?output=rss

If you try to load this URL in your browser, you'll probably see your browser's interpretation of the XML code generated by the feed. You can view the XML source with your browser's *"View Page Source"* function, though it probably will not make much sense to you. Abstractly, whenever you connect to the Google News RSS feed, you receive a **list of items**. Each **entry** in this list represents a single news **item**. In a Google News feed, every entry has the following fields:

- `guid`: A globally unique identifier for this news story.
- `title`: The news story's headline.
- `description`: A paragraph or so summarizing the news story.
- `link`: A link to a website with the entire story.
- `pubDate`: Date the news was published
- `category`: News category, such as *"Top Stories"*

### Generalizing the Problem

This is a little trickier than we'd like it to be, because each of these RSS feeds is structured a little bit differently than the others. So, our goal is to come up with a unified, standard representation that we'll use to store a news story.

We want to do this because we want an application that combines several RSS feeds from various sources and can act on all of them in the exact same way. We should be able to read news stories from various RSS feeds all in one place.

### Problem 1:

**Parsing** *(see below for a definition)* all of this information from the feeds that Google/Yahoo/etc. gives us is no small feat. So, let's tackle an easy part of the problem first. Pretend that someone has already done the specific parsing, and has left you with variables that contain the following information for a news story:

- globally unique identifier (GUID) - a string
- title - a string
- description - a string
- link to more content - a string
- pubdate - a datetime

We want to store this information in an object that we can then pass around in the rest of our program. Your task, in this problem, is to write a class called `NewsStory`, **starting with a constructor** that takes *`(guid, title, description, link, pubdate)`* as arguments and stores them appropriately. `NewsStory` also needs to contain the following methods:

- `get_guid(self)`
- `get_title(self)`
- `get_description(self)`
- `get_link(self)`
- `get_pubdate(self)`

The solution to this problem should be relatively short and very straightforward *(please review what get methods should do if you find yourself writing multiple lines of code for each)*. Once you have implemented `NewsStory` all the `NewsStory` test cases should work.

### Parsing the Feed

Parsing is the process of turning a data stream into a structured format that is more convenient to work with. We have provided you with code that will retrieve and parse the Google and Yahoo news feeds.

## Triggers

Given a set of news stories, your program will generate alerts for a subset of those stories. Stories with alerts will be displayed to the user, and the other stories will be silently discarded. We will represent alerting rules as triggers . A trigger is a rule that is evaluated over a single news story and may fire to generate an alert. For example, a simple trigger could fire for every news story whose title contained the phrase "Microsoft Office". Another trigger may be set up to fire for all news stories where the description contained the phrase "Boston". Finally, a more specific trigger could be set up to fire only when a news story contained both the phrases "Microsoft Office" and "Boston" in the description.

In order to simplify our code, we will use object polymorphism. We will define a trigger interface and then implement a number of different classes that implement that trigger interface in different ways.

### Trigger Interface

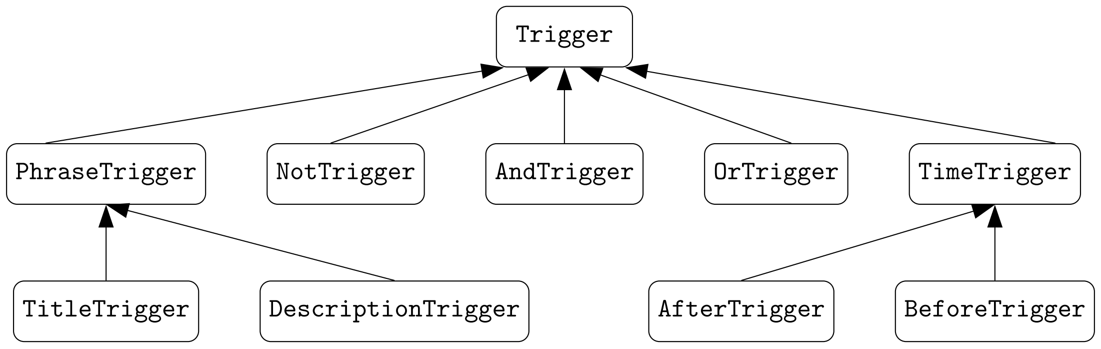
Each trigger class you define should implement the following interface, either directly or indirectly. It must implement the **evaluate** method that takes a news item (`NewsStory` object) as an input and returns `True` if an alert should be generated for that item. We will not directly use the implementation of the `Trigger` class, which is why it raises an exception should anyone attempt to use it.

The class below implements the `Trigger` interface *(you will not modify this)*. Any subclass that inherits from it will have an evaluate method. By default, they will use the evaluate method in `Trigger`, the superclass, unless they define their own evaluate function, which would then be used instead. If some subclass neglects to define its own `evaluate()` method, calls to it will go to `Trigger.evaluate()`, which fails *(albeit cleanly)* with the `NotImplementedError`:

```python
class Trigger(object):
    def evaluate(self, story):
        """
        Returns True if an alert should be generated
        for the given news item, or False otherwise.
        """
        raise NotImplementedError
```

We will define a number of classes that inherit from `Trigger`. In the figure below, `Trigger` is a superclass, from which all other classes inherit. The arrow from `PhraseTrigger` to `Trigger` means that `PhraseTrigger` inherits from `Trigger` - a `PhraseTrigger` **is a** `Trigger`. Note that other classes inherit from `PhraseTrigger`.

The class hierarchy is shown in the following class diagram:



## Phrase Triggers

Having a trigger that always fires isn't interesting; let's write some that are interesting! A user may want to be alerted about news items that contain specific phrases. For instance, a simple trigger could fire for every news item whose *title* contains the phrase *"Microsoft Office"*. In the following problems, you will create a phrase trigger abstract class and implement two classes that implement this phrase trigger.

A **phrase** is one or more words separated by a *single space* between the words. You may assume that a phrase does not contain any punctuation. Here are some examples of valid phrases:

- `'purple cow'`
- `'PURPLE COW'`
- `'mOoOoOoO'`
- `'this is a phrase'`

But these are **NOT** valid phrases:

- `'purple cow???'` *(contains punctuation)*
- `'purple        cow'` *(contains multiple spaces between words)*

Let's assume you've defined a valid phrase. Given some text, the trigger should fire only when each word in the phrase is present in its entirety and appears consecutively in the text, separated only by spaces or punctuation. The trigger should not be case sensitive. For example, a phrase trigger with the phrase "`purple cow`" should fire on the following text snippets:

- `'PURPLE COW'`
- `'The purple cow is soft and cuddly.'`
- `'The farmer owns a really PURPLE cow.'`
- `'Purple!!!  Cow!!!'`
- `'purple@#$%cow'`
- `'Did you see a purple cow?'`

Note that the text can contain extra punctuation or spaces between the words (the phrase itself can't). However, the trigger should **not** fire on the following text snippets:

- `'Purple cows are cool!'` *("cow" is not present)*

- `‘The purple blob over there is a cow.’` *(“purple” and “cow” are not consecutive)*
- `‘How now brown cow.’` *(“purple” is not present)*
- `‘Cow!!! Purple!!!’` *(words are not in the correct order)*
- `‘purplecowpurplecowpurplecow’` *(no space or punctuation between words)*

If you’ve read the above carefully, you should notice that the phrase trigger is a little tricky to implement. Dealing with exclamation marks and other punctuation that appear in the middle of the phrase inside a text is a little tricky. For the purpose of your parsing, pretend that a space or any character in `string.punctuation` is a word separator. If you’ve never seen `string.punctuation` before, go to the Python shell and type:

```
>>> import string
>>> print(string.punctuation)
```

Play around with this a bit to get comfortable with what it is. The split, replace, join methods of strings will almost certainly be helpful as you tackle this part.

You may also find the string methods lower and/or upper useful for this problem.

## Problem 2:

Implement a phrase trigger abstract class, `PhraseTrigger`. It should take in a string phrase as an argument to the class’s constructor. This trigger should not be case-sensitive *(it should treat “Intel” and “intel” as being equal)*.

`PhraseTrigger` should be a subclass of `Trigger`. It has one new method, `is_phrase_in`, which takes in one string argument text. It returns `True` if the whole phrase `phrase` is present in text, `False` otherwise, as described in the above examples. This method should not be case-sensitive. Implement this method.

Because this is an abstract class, we should not be directly instantiating any `PhraseTrigger`(s). `PhraseTrigger` should inherit its `evaluate` method from `Trigger`. We do this because now we can create subclasses of `PhraseTrigger` that use its `is_phrase_in` function.

***Tip:*** An “**abstract class**” is a class that is not intended to be instantiated directly. Instead, it is intended to be subclassed, with its subclasses providing implementations for its abstract methods. In this case, `PhraseTrigger` is an abstract class because it provides the `is_phrase_in` method, but does not provide a concrete implementation of the `evaluate` method.

### Testing Code

But we can make an exteption just to test our code. After implementing `PhraseTrigger`, Copy it to a new thonny file and then try the following simple tests in the shell:

```python
pt = PhraseTrigger("purple cow")

print(pt.is_phrase_in("Purple!!! Cow!!!"))          # True
print(pt.is_phrase_in("The purple cow is nice"))    # True
print(pt.is_phrase_in("Purple cows are cool"))      # False
print(pt.is_phrase_in("Cow purple"))                # False
print(pt.is_phrase_in("purplecow"))                 # False
```

If these behave correctly, your logic is likely working.

**Next Steps**: You are now ready to implement `PhraseTrigger`’s two subclasses: `TitleTrigger` and `DescriptionTrigger`.

## Problem 3:

Implement a phrase trigger subclass, `TitleTrigger` that fires when a news item's `title` contains a given phrase. For example, an instance of this type of trigger could be used to generate an alert whenever the phrase *"Intel processors"* occurred in the title of a news item.

As it was in `PhaseTrigger`, the phrase should be an argument to the class's constructor, and the trigger should not be case-sensitive.

**Think carefully about what methods should be defined in `TitleTrigger` and what methods should be inherited from the superclass**. Once you've implemented `TitleTrigger` , the `TitleTrigger` unit tests in our test suite should pass. Remember that all subclasses that inherit from the `Trigger` interface should include a working `evaluate` method.

### Testing Code

To test your `TitleTrigger` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, TitleTrigger
story = NewsStory("guid1", "The Purple Cow is Amazing", "Some description",
    ↪ "http://example.com", None)
tt = TitleTrigger("purple cow")
print(tt.evaluate(story))  # Should print True
tt2 = TitleTrigger("brown cow")
print(tt2.evaluate(story)) # Should print False
```

If you find that you're not passing the unit tests, keep in mind that FAIL means your code runs but produces the wrong answer, whereas ERROR means that your code crashes due to some error.

## Problem 4:

Implement a phrase trigger subclass, `DescriptionTrigger`, that fires when a news item's description contains a given phrase. As it was in `PhaseTrigger`, the phrase should be an argument to the class's constructor, and the trigger should not be case-sensitive.

Once you've implemented `DescriptionTrigger`, the `DescriptionTrigger` unit tests in our test suite should pass.

### Testing Code

To test your `DescriptionTrigger` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, DescriptionTrigger
story = NewsStory("guid1", "Some title", "The purple cow jumps over the moon",
    ↪ "http://example.com", None)
dt = DescriptionTrigger("purple cow")
print(dt.evaluate(story))  # Should print True
dt2 = DescriptionTrigger("brown cow")
print(dt2.evaluate(story)) # Should print False
```

## Time Triggers

Let's move on from `PhraseTrigger`. Now we want to have triggers that is based on when the `NewsStory` was published, not on its news content. Please check the earlier diagram if you're confused about the inheritance structure of the Triggers in this problem set.

## Problem 5:

Implement a time trigger abstract class, `TimeTrigger`, that is a subclass of `Trigger`. The class's constructor should take in time in EST as a *string* in the format of "`3 Oct 2016 17:00:10`". **Make sure to convert time from string to a `datetime` object before saving it as an attribute**. Some of `datetime`'s methods, strptime and replace, along with an explanation of the string format for time, might come in handy. You can also look at the provided code in `process` to check. You do not have to implement any other methods.

Because this is an abstract class, we will not be directly instantiating any `TimeTrigger`.

### Testing Code

To test your `TimeTrigger` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import TimeTrigger
tt = TimeTrigger("3 Oct 2016 17:00:10")
print(tt.time)  # Should print a datetime object representing the given time
```

## Problem 6:

Implement `BeforeTrigger` and `AfterTrigger`, two subclasses of TimeTrigger. `BeforeTrigger` fires when a story is published strictly before the trigger's time, and `AfterTrigger` fires when a story is published strictly after the trigger's time. Their evaluate should not take more than a couple of lines of code.

Once you've implemented `BeforeTrigger` and `AfterTrigger`, the `BeforeAndAfterTrigger` unit tests in our test suite should pass.

### Testing Code

To test your `BeforeTrigger` and `AfterTrigger` implementations, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, BeforeTrigger, AfterTrigger
story = NewsStory("guid1", "Some title", "Some description", "http://example.com",
    ↪ datetime.datetime(2023, 10, 5, 12, 0, 0))
bt = BeforeTrigger("6 Oct 2023 00:00:00")
print(bt.evaluate(story))  # Should print True
at = AfterTrigger("4 Oct 2023 00:00:00")
print(at.evaluate(story))  # Should print True
```

## Composite Triggers

So the triggers above are mildly interesting, but we want to do better: we want to *'compose'* the earlier triggers to set up more powerful alert rules. For instance, we may want to raise an alert only when both *"google glass"* and *"stock"* were present in the news item *(an idea we can't express with just phrase triggers)*.

Note that these triggers are not phrase triggers and should not be subclasses of `PhraseTrigger`. Again, please refer back to the earlier class diagram if you're confused about the inheritance structure of `Trigger`.

## Problem 7:

Implement a NOT trigger (`NotTrigger`).

This trigger should produce its output by inverting the output of another trigger. The NOT trigger should take this other trigger object as an argument to its constructor *(why its constructor? Because we can't change what parameters "`evaluate`" takes in... that'd break our polymorphism)*. So, given a trigger `T` and a news item `x`, the output of the NOT trigger's evaluate method should be equivalent to `not T.evaluate(x)`.

When this is done, the `NotTrigger` unit tests should pass.

### Testing Code

To test your `NotTrigger` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, TitleTrigger, NotTrigger
story = NewsStory("guid1", "The Purple Cow is Amazing", "Some description",
    ↪ "http://example.com", None)
tt = TitleTrigger("purple cow")
nt = NotTrigger(tt)
print(nt.evaluate(story))  # Should print False
tt2 = TitleTrigger("brown cow")
nt2 = NotTrigger(tt2)
print(nt2.evaluate(story)) # Should print True
```

## Problem 8:

Implement an AND trigger (`AndTrigger`).

This trigger should take two triggers as arguments to its constructor, and should fire on a news story only if *both* of the inputted triggers would fire on that item.

When this is done, the `AndTrigger` unit tests should pass.

### Testing Code

To test your `AndTrigger` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, TitleTrigger, DescriptionTrigger, AndTrigger
story = NewsStory("guid1", "The Purple Cow is Amazing", "A purple cow jumps over the moon",
    ↪ "http://example.com", None)
tt = TitleTrigger("purple cow")
dt = DescriptionTrigger("purple cow")
at = AndTrigger(tt, dt)
print(at.evaluate(story))  # Should print True
dt2 = DescriptionTrigger("brown cow")
at2 = AndTrigger(tt, dt2)
print(at2.evaluate(story)) # Should print False
```

## Problem 9:

Implement an OR trigger (`OrTrigger`).

This trigger should take two triggers as arguments to its constructor, and should fire if either one *(or both)* of its inputted triggers would fire on that item.

### Testing Code

To test your `OrTrigger` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, TitleTrigger, DescriptionTrigger, OrTrigger
story = NewsStory("guid1", "The Purple Cow is Amazing", "A purple cow jumps over the moon",
    ↪ "http://example.com", None)
tt = TitleTrigger("purple cow")
dt = DescriptionTrigger("brown cow")
ot = OrTrigger(tt, dt)
print(ot.evaluate(story))  # Should print True
dt2 = DescriptionTrigger("purple cow")
ot2 = OrTrigger(tt, dt2)
print(ot2.evaluate(story)) # Should print True
tt2 = TitleTrigger("brown cow")
ot3 = OrTrigger(tt2, dt)
print(ot3.evaluate(story)) # Should print False
```

When this is done, the `OrTrigger` unit tests should pass.

## Filtering

At this point, you can run `a3.py`, and it will fetch and display Google and Yahoo news items for in a pop-up window. How many news items? All of them.

Right now, the code we've given you in `a3.py` gets the news from both feeds every minute and displays the result. This is nice, but, remember, the goal here was to filter out only the the stories we wanted.

## Problem 10:

Write a function, `filter_stories(stories, triggerlist)` that takes in a list of news stories and a list of triggers, and returns a list of only the stories for which a trigger fires.

**Testing Code**

To test your `filter_stories` implementation, you can use the following code snippet *(in a new test file)*:

```python
from a3 import NewsStory, TitleTrigger, DescriptionTrigger, filter_stories
story1 = NewsStory("guid1", "The Purple Cow is Amazing", "A purple cow jumps over the moon",
    ↪ "http://example.com", None)
story2 = NewsStory("guid2", "The Brown Dog is Friendly", "A brown dog plays in the park",
    ↪ "http://example.com", None)
tt = TitleTrigger("purple cow")
dt = DescriptionTrigger("brown dog")
triggerlist = [tt, dt]
filtered_stories = filter_stories([story1, story2], triggerlist)
for story in filtered_stories:
    print(story.get_guid())  # Should print guid1 and guid2
```

After completing Problem 10, you can try running `a3.py`, and various RSS news items should pop up, filtered by some hard-coded triggers defined for you in code near the bottom. You may need to change these triggers *(defined in the* ***`triggers.txt`*** *file)* to reflect what is currently in the news. The code runs an infinite loop, checking the RSS feeds for new stories every 120 seconds.

## User-Specified Triggers

Right now, your triggers are specified in your Python code, and to change them, you have to edit your program. This is very user-unfriendly. *(Imagine if you had to edit the source code of your web browser every time you wanted to add a bookmark!)*

Instead, we want you to read your trigger configuration from a `triggers.txt` file every time your application starts and use the triggers specified there.

Consider the following example configuration file:

```
// description trigger named t1
t1,DESCRIPTION,artificial intelligence

// title trigger named t2
t2,TITLE,new smartphone

// description trigger named t3
t3,DESCRIPTION,battery breakthrough

// composite trigger named t4
t4,AND,t2,t3

// the trigger list contains t1 and t4
ADD,t1,t4
```

The example file specifies that four triggers should be created, and that two of those triggers should be added to the trigger list:

- A trigger that fires when the description contains the phrase `‘artificial intelligence’` (`t1`).
- A composite trigger that fires only when **both** of the following are true:
  - the title contains the phrase `‘new smartphone’` and
  - the description contains the phrase `‘battery breakthrough’` (`t4`).

The two other triggers (`t2` and `t3`) are created but not added to the trigger list directly. They are used as arguments for the composite AND trigger's definition (`t4`).

Each line in this text file does one of the following:

- is blank
- is a comment *(begins with `//` with no spaces preceding the `//`)*
- defines a named trigger
- adds triggers to the trigger list

Each of these types of lines is described below:

- **Blank**: blank lines are ignored. A line that consists only of whitespace is a blank line.
- **Comments**: Any line that begins with `//` is ignored.
- **Trigger definitions**: Lines that do not begin with the keyword ADD define named triggers. Elements in these lines are separated by **commas**. The first element in a trigger definition is either the keyword ADD or the name of the trigger. The name can be any combination of letters/numbers, but it cannot be the word "ADD". The second element of a trigger definition is a keyword *(e.g., TITLE, AND, etc.)* that specifies the type of trigger being defined. The remaining elements of the definition are the trigger arguments. What arguments are required depends on the trigger type:
  - **TITLE**: one phrase
  - **DESCRIPTION**: one phrase
  - **AFTER**: one correctly formatted time string
  - **BEFORE**: one correctly formatted time string
  - **NOT**: the name of the trigger that will be NOT'd
  - **AND**: the names of the two triggers that will be AND'd.
  - **OR**: the names of the two triggers that will be OR'd.
- **Trigger addition**: A trigger definition should create a trigger and associate it with a name but should NOT automatically add that trigger to the trigger list. One or more ADD lines in the trigger configuration file will specify which triggers should be in the trigger list. An ADD line begins with the ADD keyword. The elements following ADD are the names of one or more previously defined triggers. The elements in these lines are also separated by commas. These triggers will be added to the the trigger list.

## Problem 11:

Finish implementing `read_trigger_config(filename)`. We've written code to open the file and throw away all blank lines and comments. Your job is to finish the implementation. `read_trigger_config` should return a list of triggers specified by the configuration file.

***Hint:*** Feel free to define a helper function if you wish! Using a helper function is not required though.

***Hint:*** You will probably find it helpful to use a dictionary where the keys are trigger names.

Once that's done, modify the code within the function `main_thread` to use the trigger list specified in your configuration file, instead of the one we hard-coded for you:

```python
# TODO: Problem 11
# After implementing read_trigger_config, uncomment this line:
# triggerlist = read_trigger_config('triggers.txt')
```

After completing Problem 11, you can try running `a3.py`, and depending on your `triggers.txt` file, various RSS news items should pop up. The code runs an infinite loop, checking the RSS feed for new stories every 120 seconds.

***Hint:*** If no stories are popping up, open up `triggers.txt` and change the triggers to ones that reflect current events *(if you don't keep up with the news, just pick some triggers that would fire on the current Google News stories).*

## Problem 12:

Think about a major global event that is happening right now and write a `my_triggers.txt` file that alerts you to news stories published within a +/- 3 hour window of the event's start time. Your trigger configuration should use time-based triggers to capture stories posted shortly before, during, and shortly after the event.

## Hand-in Procedure

### Naming Files

Save your solutions with the original file name: `a3.py`. Be sure to follow this naming convention exactly. The autograder will not be able to find your file if you do not and you will receive no marks.

### Final Submission

- Be sure to run the student tester and make sure all the tests pass. However, the student tester contains only a subset of the tests that will be run to determine the problem set grade. Passing all of the provided test cases does not guarantee full credit on assignment 3.
- Submission is on moodle, just one file i.e. `a3.py`.