MockDetector: A technique to identify mock objects created in unit tests

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ABSTRACT

Software dependencies are ubiquitous and may pose problems during testing, because creating usable objects from dependencies is often complicated. Developers, therefore, often introduce mock objects to stand in for dependencies during testing. However, to our knowledge, no static analysis framework provides a tool to automatically identify mock objects created in the unit test cases. The lack of mock object detection can decrease the precision of static analyses, as they are unable to separate methods invoked on mock objects from methods invoked on actual objects.

In this paper, we introduce MockDetector, a technique to identify mock objects. It is able to detect common Java mock libraries' APIs that create mock objects, checking whether there is a call to a mock creation site and then a def-use chain reaching the point of use. Implications of understanding which objects are mock objects include helping static analysis tools identify which dependencies' methods are actually tested, versus mock methods being called.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

KEYWORDS

static analysis, mock objects, unit tests

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1 INTRODUCTION

2 MOTIVATING EXAMPLE

In this section, we illustrate how our MockDetector tool finds a mock object created within a unit test case. Our tool identifies variables which have been assigned an object flowing from a mock creation site through a def-use chain (possibly of length 0).

We would like to discuss an example to illustrate our motivation for this project. Listing 1 illustrates a method *addAll()* that is invoked on a mocked object of Type Collection<Number>. Current static analysis tools, to our knowledge, are unable to distinguish this method invocation on a mocked object from the method invocation on an actual object with call graph analysis. Therefore, the current tools would treat the method invocations on mocked objects as the behaviour getting tested, whereas the purpose of the method invocations on mocked objects are intended to make them fulfill the dependencies, so that the actual object's behaviour can be properly tested.

Listing 2 shows the unit test case *testSimpleResolution()* in the benchmark byte-buddy-dep (version 1.7.10) where the mock object TypeDescription is created via a direct call to Java mocking library Mockito's *mock(java.lang.class)*. In this example, our MockDetector tool would utilizes Soot [**?**] to locate the statements that are instances of Assignment Statement with an invoke expression at the right operand, i.e. def-use chain of length 0. It then checks if the method invoked matches with any Java mocking libraries' APIs creating a mock object, by matching the method name, parameter types, and return type (i.e. the method subsignature).

Meanwhile, Listing 3 illustrates the unit test case *testGetIterator()* in the benchmark commons-collections4 (version 4.3), where the array of Node, consists of mock objects created in the helper function *createNodes()*, under this transitive call scenario. In this example with a def-use chain, our tool would first detect the Java mocking library that is in use within the benchmark, and retrieve the corresponding API creating a mock object from the detected Java mocking library. It then utilizes Soot's ReachableMethods with the input of a constructed call graph and the iterator consists of the specific, and checks if any of the statements in the unit test case's body, contains a method invocation that could eventually reach the API.

```
@Test
public void addAllForIterable() {
        ...
        final Collection<Number> c = createMock(Collection.class);
        ...
        expect(c.addAll(inputCollection)).andReturn(true);
        ...
}
```

Listing 1: This code snippet illustrates an example where the method is invoked on a mocked object in unit test case *addAllForIterable()*

```
import static org.mockito.Mockito.mock;

...

@Test
public void testSimpleResolution() throws Exception {
        TypeDescription typeDescription = mock(TypeDescription.class);
        ...
}
```

Listing 2: This example illustrates a direct call to Mockito's *mock(java.lang.class)* function from test case *testSimpleResolution()*.

```
private Node[] createNodes() {
        final Node node1 = createMock(Node.class);
        ...
}

@Test
public void testGetIterator() {
        ...
        final Node[] nodes = createNodes();
        ...
}
```

Listing 3: This example illustrates a transitive call to EasyMock's *CreateMock(java.lang.class)* function from test case *testGetIterator()*.

3 TECHNIQUE

4 EVALUATION

5 CONCLUSION

6 MATH EQUATIONS

You may want to display math equations in three distinct styles: inline, numbered or non-numbered display. Each of the three are discussed in the next sections.

6.1 Inline (In-text) Equations

A formula that appears in the running text is called an inline or in-text formula. It is produced by the **math** environment, which can be invoked with the usual `\begin . . . \end` construction or with the short form `$ . . . $`. You can use any of the symbols and structures, from α to ω, available in LaTeX [**?**]; this section will simply show a few examples of in-text equations in context. Notice how this equation: $\lim_{n\rightarrow \infty}x = 0$, set here in in-line math style, looks slightly different when set in display style. (See next section).

6.2 Display Equations

A numbered display equation—one set off by vertical space from the text and centered horizontally—is produced by the **equation** environment. An unnumbered display equation is produced by the **displaymath** environment.

Again, in either environment, you can use any of the symbols and structures available in LaTeX; this section will just give a couple of examples of display equations in context. First, consider the equation, shown as an inline equation above:

$$\lim_{n\rightarrow \infty}x = 0 \tag{1}$$

Notice how it is formatted somewhat differently in the **displaymath** environment. Now, we'll enter an unnumbered equation:

$$\sum_{i=0}^{\infty} x + 1$$

and follow it with another numbered equation:

$$\sum_{i=0}^{\infty}x_i=\int_{0}^{\pi+2} f \tag{2}$$

just to demonstrate LaTeX's able handling of numbering.

7 FIGURES

Your figures should contain a caption which describes the figure to the reader.

Figure captions are placed *below* the figure.

Every figure should also have a figure description unless it is purely decorative. These descriptions convey whats in the image to someone who cannot see it. They are also used by search engine crawlers for indexing images, and when images cannot be loaded.

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7.1 The "Teaser Figure"

A "teaser figure" is an image, or set of images in one figure, that are placed after all author and affiliation information, and before the body of the article, spanning the page. If you wish to have such a figure in your article, place the command immediately before the `\maketitle` command:

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  \includegraphics[width=\textwidth]{sampleteaser}
  \caption{figure caption}
```

```
  \Description{figure description}
\end{teaserfigure}
```

8 CITATIONS AND BIBLIOGRAPHIES

The use of BibTeX for the preparation and formatting of one's references is strongly recommended. Authors' names should be complete — use full first names ("Donald E. Knuth") not initials ("D. E. Knuth") — and the salient identifying features of a reference should be included: title, year, volume, number, pages, article DOI, etc.

The bibliogrphy is included in your source document with these two commands, placed just before the `\end{document}` command:

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\bibliographystyle{ACM-Reference-Format}
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Citations and references are numbered by default. A small number of ACM publications have citations and references formatted in the "author year" style; for these exceptions, please include this command in the **preamble** (before the command "`\begin{document}`") of your LaTeX source:

```
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9 ACKNOWLEDGMENTS

Identification of funding sources and other support, and thanks to individuals and groups that assisted in the research and the preparation of the work should be included in an acknowledgment section, which is placed just before the reference section in your document.

This section has a special environment:

```
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...
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```

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10 APPENDICES

If your work needs an appendix, add it before the "`\end{document}`" command at the conclusion of your source document.

Start the appendix with the "`appendix`" command:

```
\appendix
```

and note that in the appendix, sections are lettered, not numbered. This document has two appendices, demonstrating the section and subsection identification method.

11 SIGCHI EXTENDED ABSTRACTS

The "`sigchi-a`" template style (available only in LaTeX and not in Word) produces a landscape-orientation formatted article, with a wide left margin. Three environments are available for use with the "`sigchi-a`" template style, and produce formatted output in the margin:

- `sidebar`: Place formatted text in the margin.
- `marginfigure`: Place a figure in the margin.
- `margintable`: Place a table in the margin.

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To Robert, for the bagels and explaining CMYK and color spaces.

A RESEARCH METHODS

A.1 Part One

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A.2 Part Two

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