

Integrated Ethics

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Course CS1 **Knowledge Unit** Fundamental Programming Concepts

Programming Language Java **Resource Type** Other Material Type

CS Concepts III. Control Structures and Control Flow; IV. Functions / Procedures / Methods; VI. Collections / Data Structures

Keywords Lists, Loops, Conditionals, Sets, Ethics

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ACM Reference Format

Structured Abstract

Synopsis

Integrated Ethics is a series of assignments that help students gain experience and proficiency with conditionals, loops, and sets. In addition, students will learn how technologies like targeted digital advertising, workflow automation, and data collection and analytics can cause unintended harms to users, workers, and society.

In each assignment, students are presented with a real-world problem, such as writing code to show ads to users based on their interests or constructing a program to produce income statements from a business's transaction history. After students have written their code – normally by filling out the implementation for a given function signature – they are given follow-up readings focusing on the problem they've just solved and how it affects people in the real world. The main objectives of the assignment are (a) to expose students to real-world applications of fundamental programming constructs and (b) to grapple with the varying impacts of their code on our society.

Engagement Highlights

These assignments provide meaningful and relevant content by grounding the coding exercises in real-world applications, including digital advertising, workflow automation, and data collection and analytics. To this end, we supplement the coding portions of each assignment with readings so that students may engage with the relevant social issues more deeply. Importantly, these readings are optional to incorporate student choice: depending on the interests of a student, they may or may not be interested in the larger impacts of their code – or have sufficient time to engage with the readings -- and we want to be cognizant of these differing interests.

Recommendations

These assignments focus on three topics: conditionals, lists and loops, and sets. The function signatures and reference solutions are written in Java, but they can easily be adapted for other programming languages. Importantly, the impacts of these assignments could be enhanced by holding small-group discussions focused on the reading material.

Resource Details

Introduction

These assignments demonstrate how technologies like targeted digital advertising, workflow automation, and data collection and analytics can cause unintended harm to users and society. Students will implement the basic algorithms underpinning these technologies and engage with the social aspects through follow-up articles included with each assignment.

Implementation Guidelines

For each assignment, students are given a problem description and a Java function signature that they must fill out. For instructors, we provide a reference solution – also written in Java – that may be used as the foundation for automated grading. Included in each document are links to follow-up articles that students may read to learn more about an assignment's social issue.

Marking Guidelines

A reference implementation for each assignment is provided. Instructors may use this solution implement an automated grader for student-written functions if they choose.

Extensions and Modifications

As an exercise, we recommend instructors hold discussions around the social issues relevant to each problem, namely data privacy (in the first and third problems) and unemployment caused by automation (the second problem). Discussion questions for students include, but are not limited to:

- Who is impacted -- both positively and negatively -- by the technology you've implemented in this assignment?
- What is your personal relationship to this technology?
- How might we, as technologists, build this technology in a more safe, responsible, and equitable way?

Acknowledgements

These assignments were inspired by the work of many researchers in computing ethics, including Barbara Grosz and Jeff Behrends (from Harvard's Embedded EthiCS program), Evan Peck, and Casey Fiesler. Specifically, our first problem is based off the paper *Integrating Ethics into Introductory Programming Classes*, of which Casey was an author.

References

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Materials

- **Assignment handouts:**
 - DigitalAdvertising.docx
 - WorkflowAutomation.docx
 - StudentDataPrivacy.docx
- **Reference solutions:**
 - DigitalAdvertisingSolution.java
 - WorkflowAutomationSolution.java
 - StudentDataPrivacySolution.java