THE ONLINE PROGRAMMING CHALLENGE

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Setting the Scene

Information Technology is ubiquitous in modern society, which presents both advantages but also challenges when teaching it as an academic discipline. In our experience teaching university and high school students we identified a number of problems:

1. School students in remote and rural Australia often **lack access** to people with sufficient expertise in modern computing.

2. Learning programming requires **regular feedback** to correct errors and most undergraduate courses have limited supervised laboratory and tutorial hours.

3. Marking code submitted for assignments and exams is **time consuming** and difficult to do without running the programs and testing their output.

Students are enthusiastic adopters of new technology, so with this in mind we developed the **Challenge** website, an online environment for learning programming. The Challenge site also provides support for assessment submission, marking, and online student communities.

The Students

We have developed this system with several student groups in mind:

- **Advanced First Year Students** — The Challenge site allows us to provide many practice questions and extension activities for our top IT students in INFO1903 Informatics (Advanced).

> It has been my observation that the students and teachers who participate in the NCSS Challenge feel less isolated and feel more confident and comfortable since they are doing the same activities as the urban students. They feel they are heading in the same direction as their urban counterparts.
> Steven Madsen, President, CS Teachers Association of NSW

- **High School Students** — Each year 1500 students from around Australia participate in our NCSS online programming challenge which uses the site.

> The very well-structured coursework and challenge website. It makes it very clear what knowledge that we ought to have and makes it clear if we don't have it.
> ENGG1801 Student Feedback

- **First Year Engineering Students** — We rolled out the Challenge site for use with MATLAB for 750 engineering students doing ENGG1801 Engineering Computing.

A Resource for Education Research

The Challenge site also helps us to learn about teaching programming. We now have a database of

- Over 200 000 student submissions
- Over 20 000 forum posts about programming problems

This database includes **73 unique incorrect solutions** to the classic program "Hello World". Analysis of this data will help us understand common programming misconceptions.

We estimate that the feedback high school students received through the online challenge is equivalent to over 5000 hours of teacher time.

Acknowledgments

We would like to acknowledge contributions of Michael Cahill, Tim Dawborn and Will Cannings from the School of Information Technologies, and the many students who developed questions and mentored students on the site.

The development of the MATLAB component of the system for engineering students was supported by the Faculty of Engineering and Information Technologies and a large TIES grant.
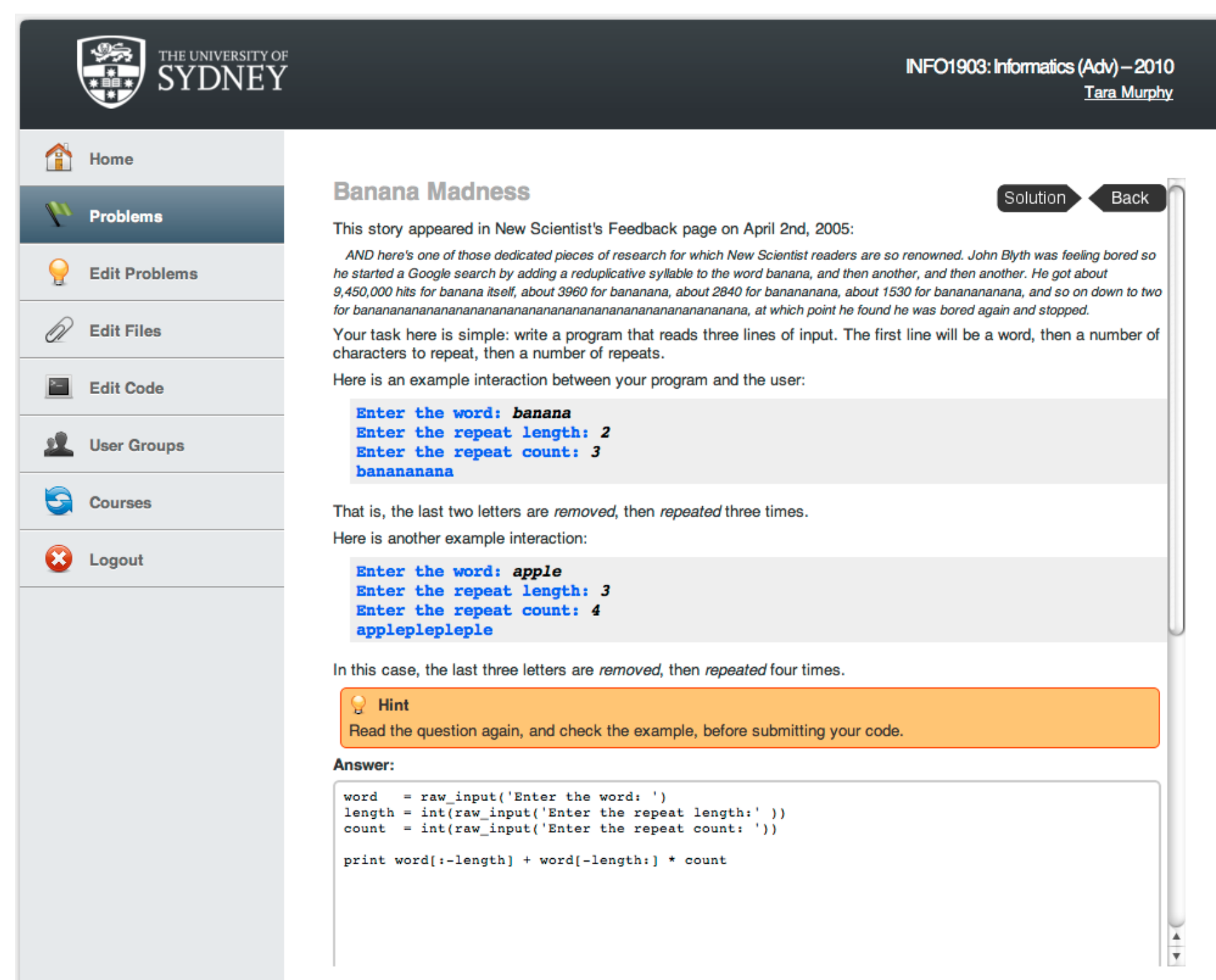

Figure 1: *A typical beginners question used in INFO1903 and the NCSS Challenge which are both run in the **Python** programming language.*
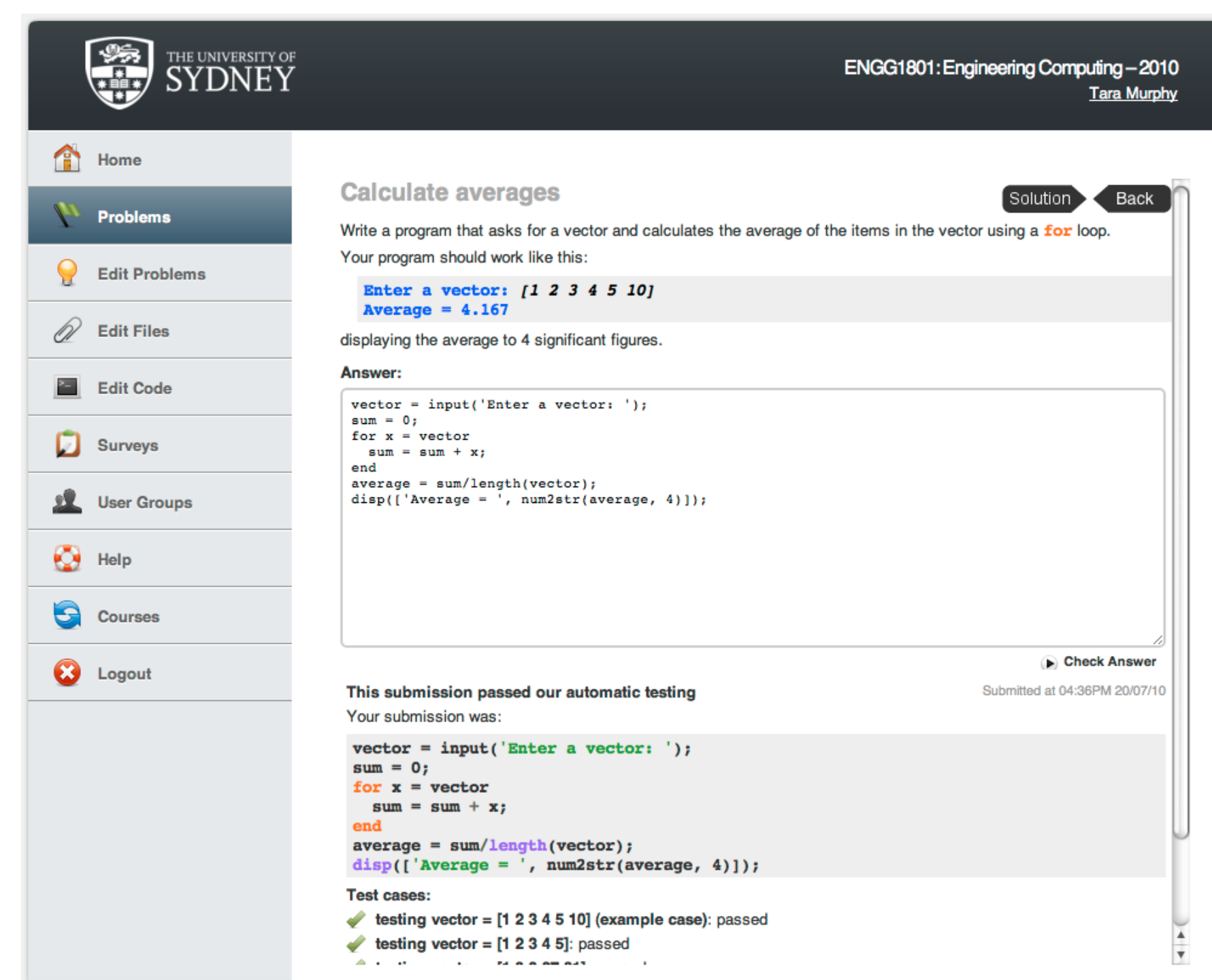

Figure 2: *A typical engineering question in **MATLAB** from ENGG1801. Students receive immediate feedback on their solutions.*
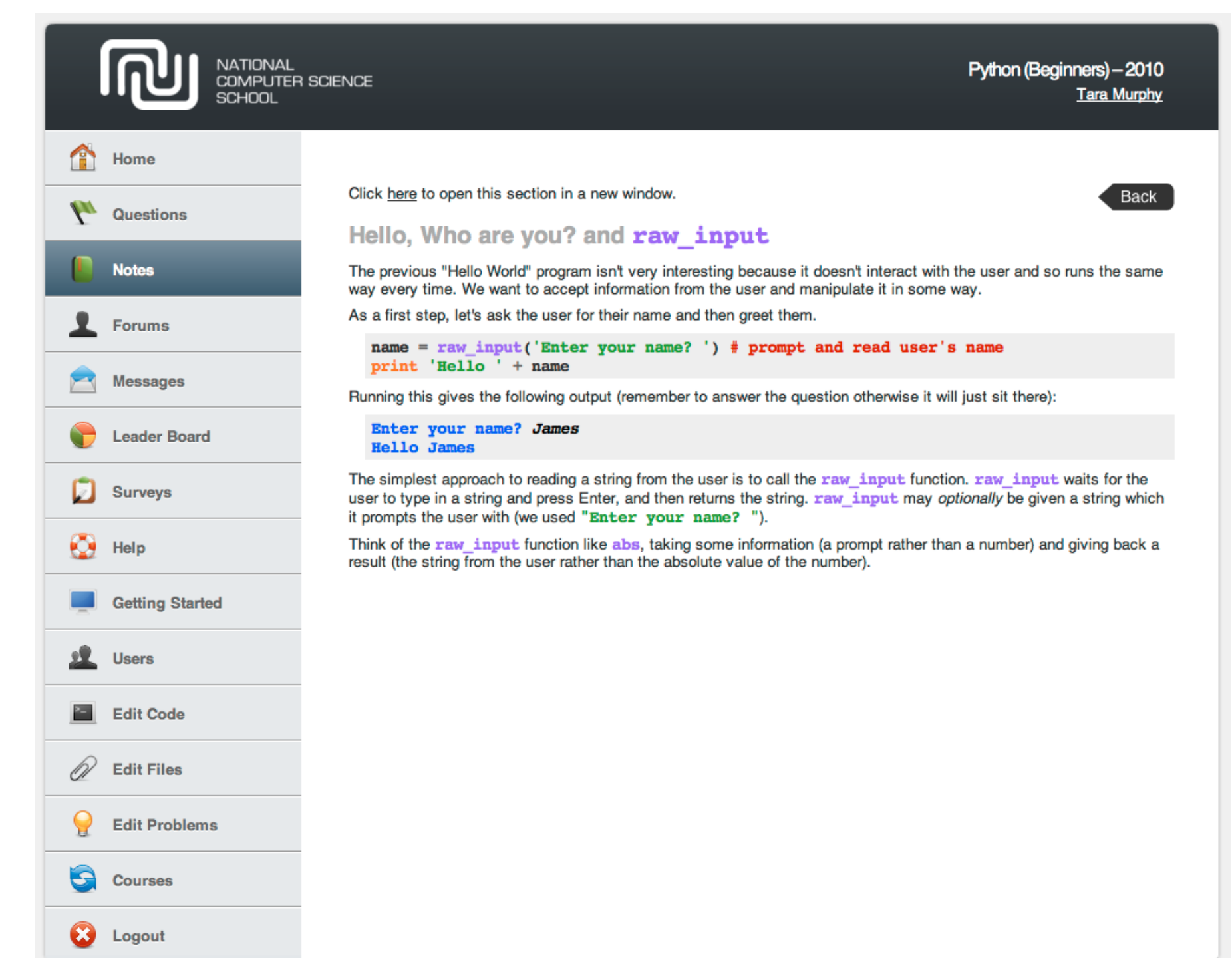

Figure 3: *Students can access self-contained notes on relevant aspects of each module. Teachers can print these and use them as an in-class resource.*