

Towards a MOOC for Teaching Introductory Programming @ Griffith – a Case Study

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- In 2012, a revised approach was taken to teaching introductory programming at Griffith's Gold Coast campus and within some Queensland High schools.
- In addition to on-campus lectures and workshops, an on-line environment was introduced (JPL¹) which consisted of the three components listed on the following pages (Knowledge, Practical, Assessment). Used by over 1,500 students to date.
- Following on from the success of this approach (see later slide) the decision has been made to extend the course and make it fully on-line.
- Anyone will have access to the Knowledge and Practical components but only students enrolled at Griffith will have access to the Assessment component.

Knowledge Component

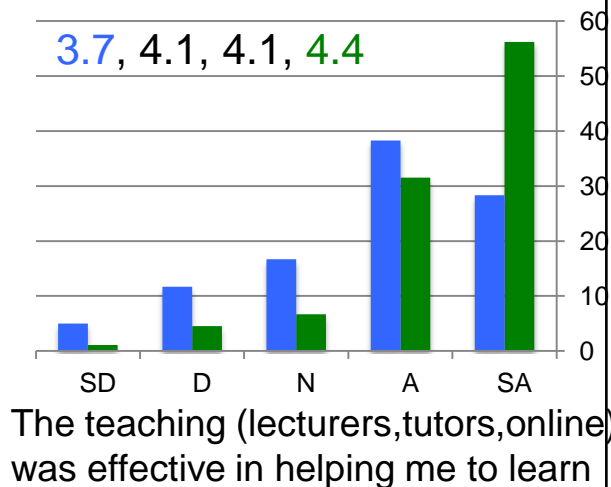
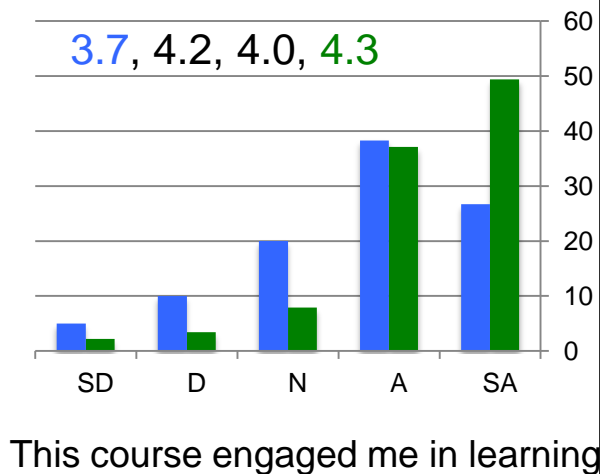
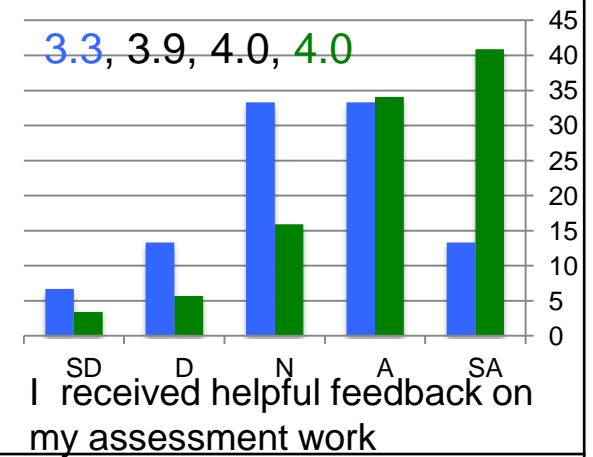
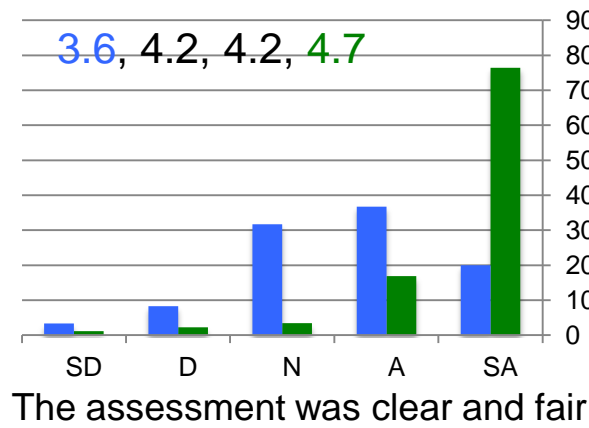
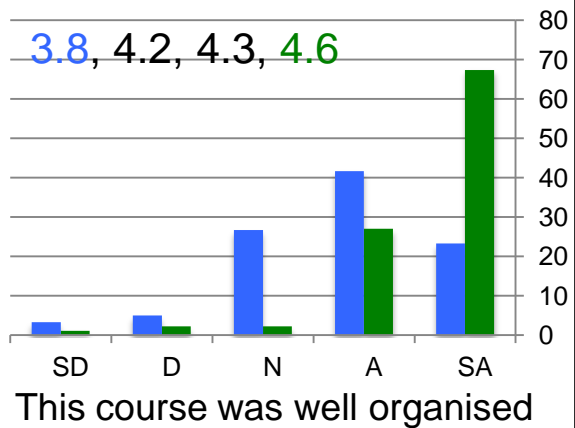
- Current Knowledge Component
 - a. Interactive web pages for more content detail
 - b. Practice on-line quizzes (On-line marking)
- Fully On-line Knowledge Component Extensions
 - a. Topic specific, video mini-lectures (10 – 15 minutes) with slides available
 - b. Interactive assistance (Collaborate)

- Current Practical Component
 - a. Practice Environment: Lots of small, scaffolded targeted problems with automated testing
 - b. Assistance: 10 minute videos of tutor solving a problem, remote assistance directly into students source files, Hints, Solutions
 - c. Feedback: Automated testing, provided solutions
- Fully On-line Knowledge Component Extensions
 - a. Practice Environment: automatic check of problem statement understanding before allowed to start coding
 - b. Assistance: more 10 minute videos of tutor solving problems, Collaborate / Workshop (Videoed), video responses to students, extended solutions, On-Line Question Database
 - c. Feedback: analysis of students solution, provided solutions when student successful

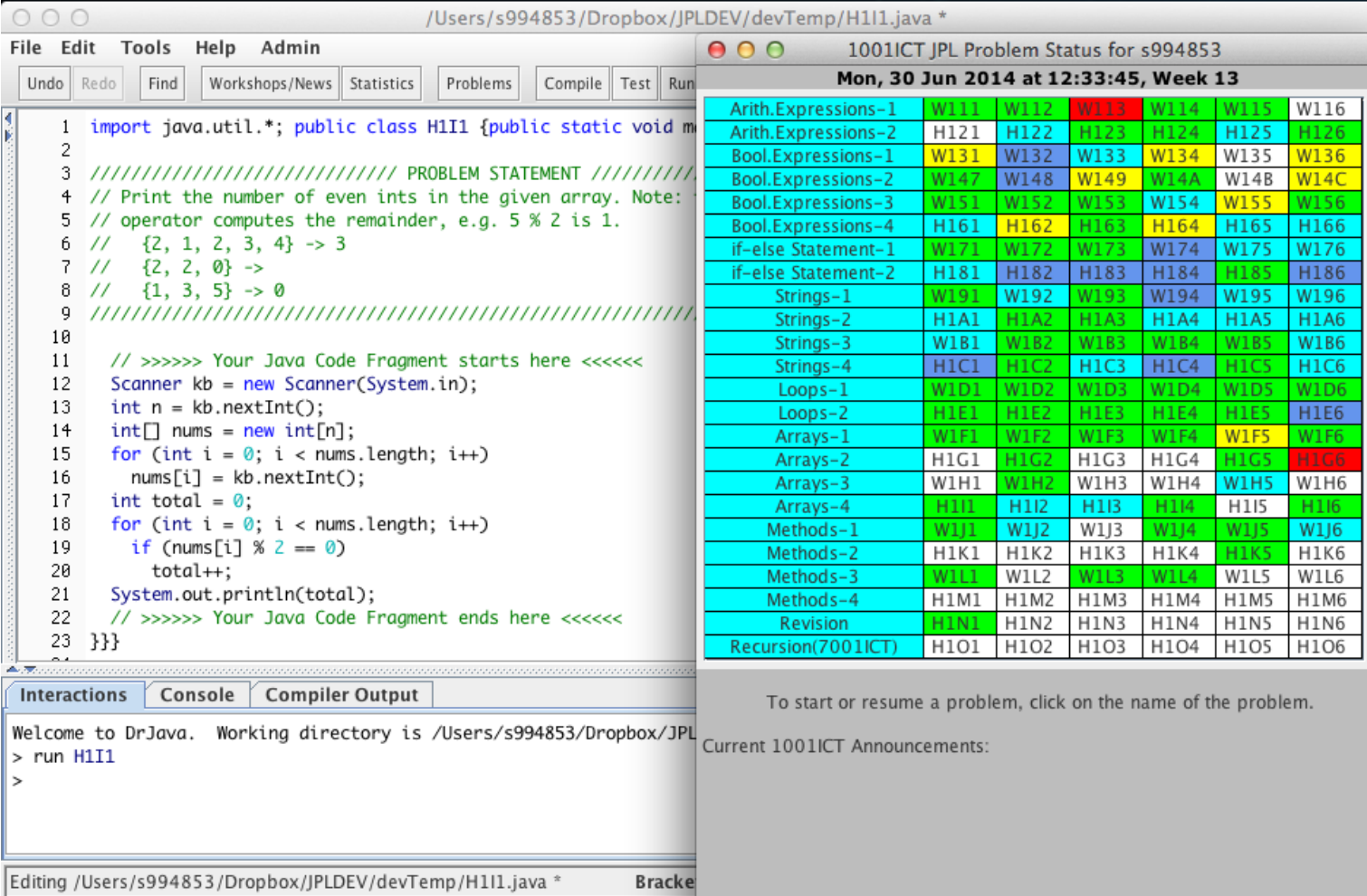
- Current Assessment Component
 - a. Multiple choice tests (25%)
 - b. Randomised Assessed Labs (25%)
 - c. Invigilated, final examination (50%)
- Fully On-line Assessment Component Extensions
 - a. Randomised multiple choice tests (20%)
 - b. Randomised multi-part assignment (20%)
 - c. Invigilated, must attain more than 65%, final examination (60%)

2011 – 2014 SEC (5 point scale)

SEC (Means shown as 2011, 2012, 2013, 2014)



Practical Component Interfaces



The screenshot displays the JPLIDE interface with three main components:

- Code Editor:** Shows a Java program named `H1I1` that counts even numbers in an array. The code includes comments for the problem statement and instructions for the student's code fragment.
- Console:** Shows the command `> run H1I1` and the output `>`.
- Problem Status Table:** A table listing various problems and their associated student IDs. The table is titled "1001ICT JPL Problem Status for s994853" and dated "Mon, 30 Jun 2014 at 12:33:45, Week 13".

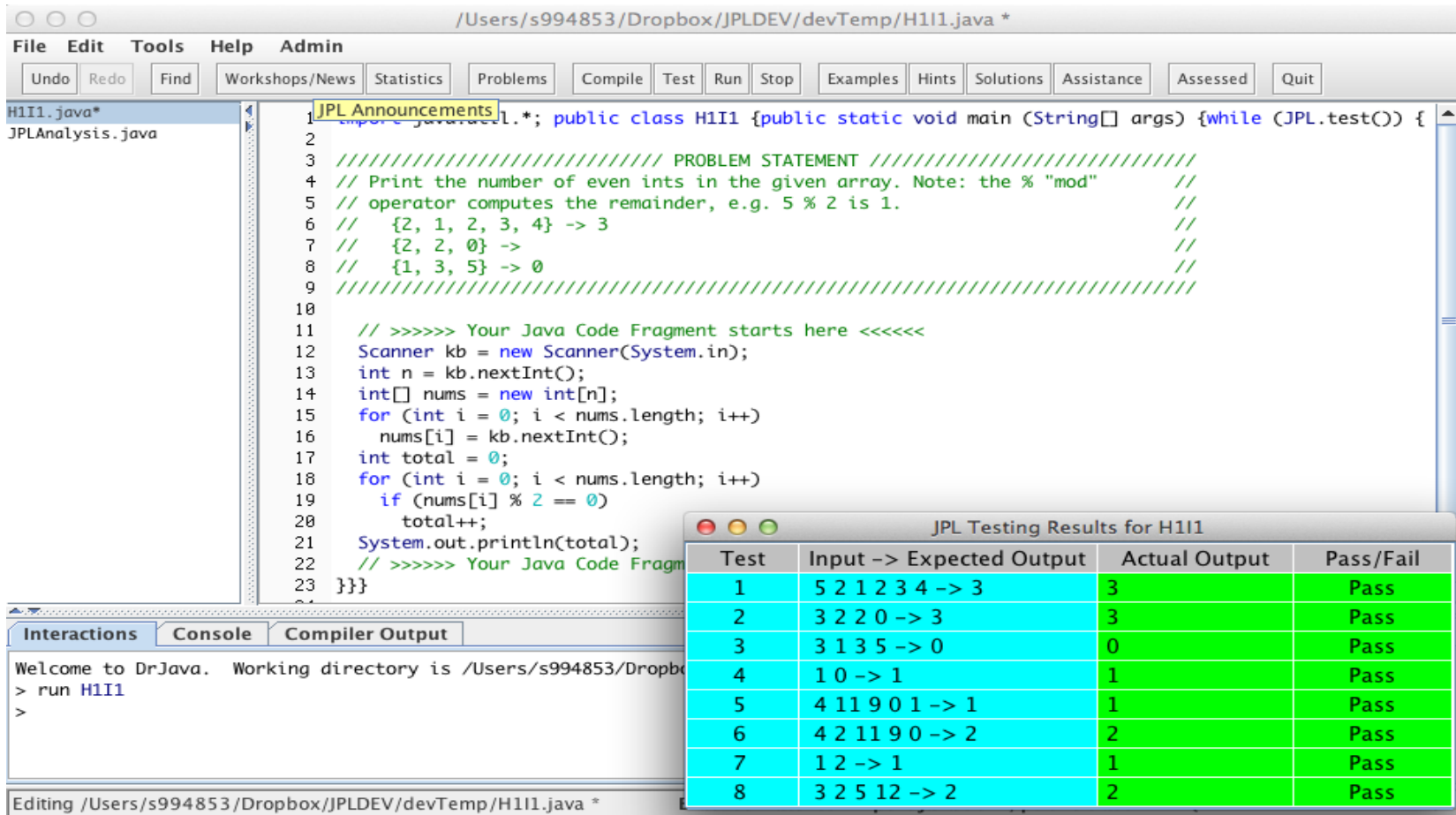
1001ICT JPL Problem Status for s994853						
Mon, 30 Jun 2014 at 12:33:45, Week 13						
Arith.Expressions-1	W111	W112	W113	W114	W115	W116
Arith.Expressions-2	H121	H122	H123	H124	H125	H126
Bool.Expressions-1	W131	W132	W133	W134	W135	W136
Bool.Expressions-2	W147	W148	W149	W14A	W14B	W14C
Bool.Expressions-3	W151	W152	W153	W154	W155	W156
Bool.Expressions-4	H161	H162	H163	H164	H165	H166
if-else Statement-1	W171	W172	W173	W174	W175	W176
if-else Statement-2	H181	H182	H183	H184	H185	H186
Strings-1	W191	W192	W193	W194	W195	W196
Strings-2	H1A1	H1A2	H1A3	H1A4	H1A5	H1A6
Strings-3	W1B1	W1B2	W1B3	W1B4	W1B5	W1B6
Strings-4	H1C1	H1C2	H1C3	H1C4	H1C5	H1C6
Loops-1	W1D1	W1D2	W1D3	W1D4	W1D5	W1D6
Loops-2	H1E1	H1E2	H1E3	H1E4	H1E5	H1E6
Arrays-1	W1F1	W1F2	W1F3	W1F4	W1F5	W1F6
Arrays-2	H1G1	H1G2	H1G3	H1G4	H1G5	H1G6
Arrays-3	W1H1	W1H2	W1H3	W1H4	W1H5	W1H6
Arrays-4	H1I1	H1I2	H1I3	H1I4	H1I5	H1I6
Methods-1	W1J1	W1J2	W1J3	W1J4	W1J5	W1J6
Methods-2	H1K1	H1K2	H1K3	H1K4	H1K5	H1K6
Methods-3	W1L1	W1L2	W1L3	W1L4	W1L5	W1L6
Methods-4	H1M1	H1M2	H1M3	H1M4	H1M5	H1M6
Revision	H1N1	H1N2	H1N3	H1N4	H1N5	H1N6
Recursion(7001ICT)	H1O1	H1O2	H1O3	H1O4	H1O5	H1O6

To start or resume a problem, click on the name of the problem.

Current 1001ICT Announcements:

- JPLIDE interface – selecting a problem
- Students' files saved centrally
- JPLIDE handles Java, C++, C#, Python

Practical Component Interfaces



The screenshot shows the DrJava IDE interface. The main window displays the source code for `H111.java`. The code includes a `JPL Announcements` block and a `main` method that reads integers from the user and counts the number of even integers. The code is as follows:

```
1 JPL Announcements
2
3 //////////////////////////////////////////////////////////////////// PROBLEM STATEMENT ////////////////////////////////////////////////////////////////////
4 // Print the number of even ints in the given array. Note: the % "mod"
5 // operator computes the remainder, e.g. 5 % 2 is 1.
6 // {2, 1, 2, 3, 4} -> 3
7 // {2, 2, 0} ->
8 // {1, 3, 5} -> 0
9 ////////////////////////////////////////////////////////////////////
10
11 // >>>>> Your Java Code Fragment starts here <<<<<<
12 Scanner kb = new Scanner(System.in);
13 int n = kb.nextInt();
14 int[] nums = new int[n];
15 for (int i = 0; i < nums.length; i++)
16     nums[i] = kb.nextInt();
17 int total = 0;
18 for (int i = 0; i < nums.length; i++)
19     if (nums[i] % 2 == 0)
20         total++;
21 System.out.println(total);
22 // >>>>> Your Java Code Fragment ends here <<<<<<
23 }}}
```

The console window shows the following interactions:

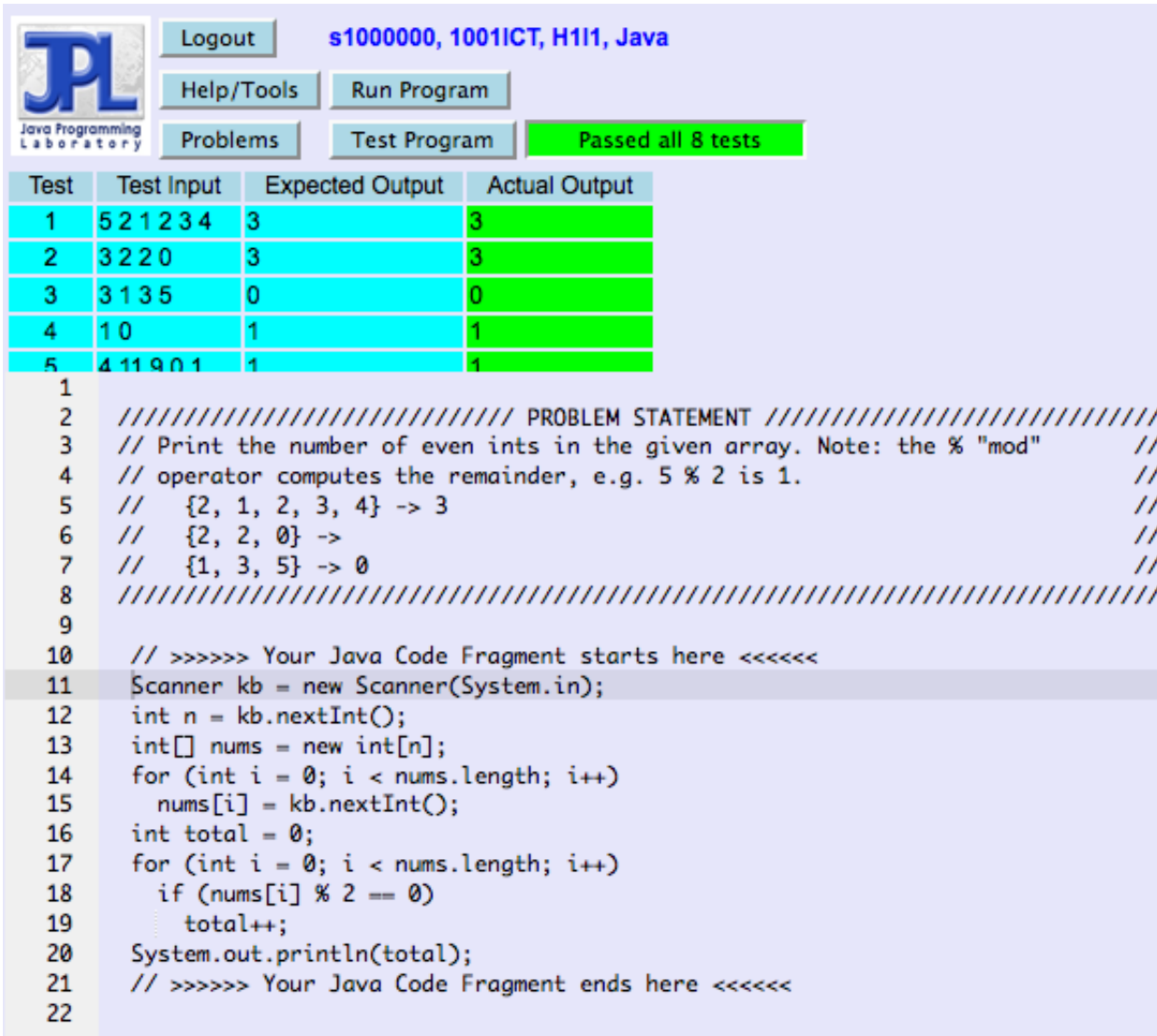
```
Welcome to DrJava. Working directory is /Users/s994853/Dropbox/JPLDEV/devTemp
> run H111
>
```

The JPL Testing Results window for `H111` displays the following table:

Test	Input -> Expected Output	Actual Output	Pass/Fail
1	5 2 1 2 3 4 -> 3	3	Pass
2	3 2 2 0 -> 3	3	Pass
3	3 1 3 5 -> 0	0	Pass
4	1 0 -> 1	1	Pass
5	4 1 1 9 0 1 -> 1	1	Pass
6	4 2 1 1 9 0 -> 2	2	Pass
7	1 2 -> 1	1	Pass
8	3 2 5 12 -> 2	2	Pass

- JPLIDE interface – successful test

Practical Component Interfaces



The screenshot shows the JPL web interface. At the top left is the JPL logo (Java Programming Laboratory). To its right are buttons for "Logout", "Help/Tools", "Problems", "Run Program", and "Test Program". The user's session information is "s1000000, 1001ICT, H111, Java". A green banner indicates "Passed all 8 tests".

Test	Test Input	Expected Output	Actual Output
1	5 2 1 2 3 4	3	3
2	3 2 2 0	3	3
3	3 1 3 5	0	0
4	1 0	1	1
5	4 1 1 9 0 1	1	1

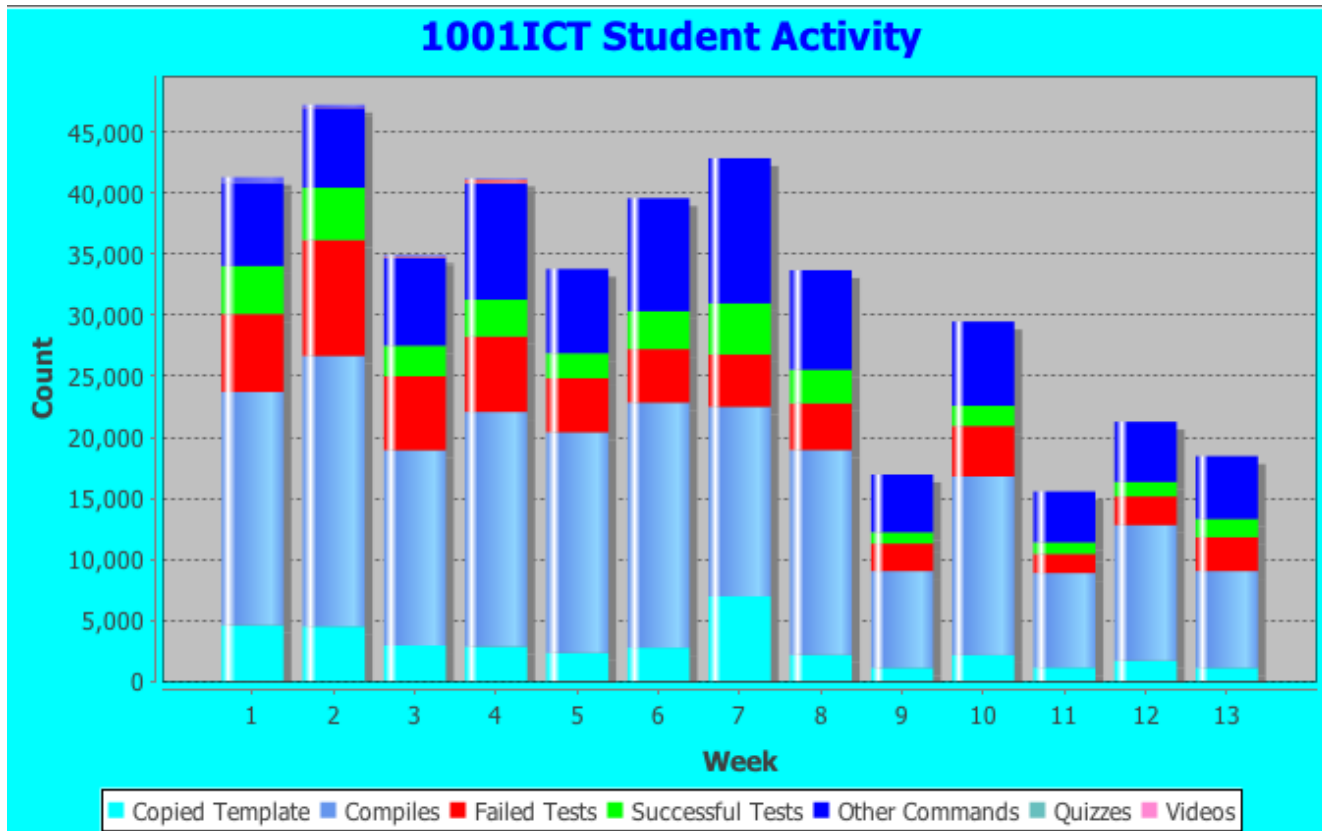
```
1
2  //////////////////////////////////// PROBLEM STATEMENT ////////////////////////////////////
3  // Print the number of even ints in the given array. Note: the % "mod"           //
4  // operator computes the remainder, e.g. 5 % 2 is 1.                             //
5  // {2, 1, 2, 3, 4} -> 3                                                           //
6  // {2, 2, 0} ->                                                                    //
7  // {1, 3, 5} -> 0                                                                 //
8  ////////////////////////////////////
9
10 // >>>>> Your Java Code Fragment starts here <<<<<<
11 Scanner kb = new Scanner(System.in);
12 int n = kb.nextInt();
13 int[] nums = new int[n];
14 for (int i = 0; i < nums.length; i++)
15     nums[i] = kb.nextInt();
16 int total = 0;
17 for (int i = 0; i < nums.length; i++)
18     if (nums[i] % 2 == 0)
19         total++;
20 System.out.println(total);
21 // >>>>> Your Java Code Fragment ends here <<<<<<
22
```

- webJPL interfaces to same problems
- webJPL handles Java, C++, C#, Python
- Access same students files as JPLIDE

For a 2014/1 class of around **170** 1001ICT students at the GC:

1. JPLIDE Starts = **15,026**
2. Total JPLIDE Commands = **415,242**
3. Open JPL Template = **33,467**, Compiles = **196,469**, Failed Tests = **58,271**, Passed Tests = **31,989**
4. Total JPLIDE Dev. Commands = **334,431 (80.54%)**
5. Off-campus activity is **70.00%** of total activity

2014 Semester 1 Activity



As problems become harder, students command input slows down

2012 - 2014 Student Numbers

Year	Griffith Students	High School Students	Overseas University
2012	380		60
2013	400	60	80
2014	420	120	90

To date, JPL has been restricted to on-campus courses so limited to formally enrolled students

- To fully open up the current JPL-driven course (1001ICT)
- Integration of high school students with the greater University student community
 - Plugging the JPL into an engagement platform
- Collaboration opportunity: “MOOC on MOOCS”
 - Can be pursued more broadly through ACDICT members