PeerWise

Students sharing and evaluating their MCQs

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Overview

• Description
  – intended benefits
• Demonstration
• Studies
  – usage patterns
  – student attitudes
  – question quality
  – efficacy
• Problems and future work
PeerWise

- Web-based MCQ repository built by students
- Students:
  - develop new questions with associated explanations
  - answer existing questions and rate them for quality and difficulty
  - take part in discussions
  - subscribe to authors they like
  - compete with other students to appear on leaderboards
Intended benefits

• To students
Intended benefits

• To students
  – focuses attention on learning outcomes

"What I found most interesting was how other people structured their questions. It kind of made me think about what kind of topics or concepts people felt were important to the course, hence their choice of making a question on a particular topic."
Intended benefits

• To students
  – focuses attention on learning outcomes
  – express understanding in their own words

"When I try to create questions, I realized that I have to fully understand the topic."

"The biggest learning experience for me was setting up my multi-choice question...

...in the end it was a lot of help because I was just about able to answer any question that was on the same topic as my question"
Intended benefits

• To students
  – focuses attention on learning outcomes
  – express understanding in their own words
  – question bank for drill and practice revision

"I answered over 100 questions, it was a quick way to test my knowledge and if I got the answer wrong the explanations helped me learn something I wasn't too sure with."
Intended benefits

• To students
  – focuses attention on learning outcomes
  – express understanding in their own words
  – question bank for drill and practice revision
  – peer comparison

"Being able to see how other people answered was great as it allowed me to recognise at which level I was at compared to everyone else"

"The biggest benefit of using PeerWise was getting an understanding of the kind of level of questions and knowledge that is possessed by other students"
Demonstration
Intended benefits

• To staff
Intended benefits

• To staff
  – unique insight into
    • what students feel is important
    • the capabilities of students, and what they are learning
Intended benefits

• To staff
  – unique insight into
    • what students feel is important
    • the capabilities of students, and what they are learning
  – large relevant question banks, rated and discussed by students
    • ENGGGEN 131, UoA Second Semester 2007, 6 weeks:
      – 570 students
      – 1,700 questions
      – 35,000 answers
Studies

• Do students use PeerWise voluntarily?
  – usage patterns

• How do students feel about this activity?
  – student attitudes

• Are students developing good quality questions?
  – question quality

• Is activity correlated with performance?
  – efficacy
Usage Patterns
Usage patterns

- Do students use PeerWise voluntarily?
  - COMPSCI 101 course, UoA First Semester 2007 (530 students)
  - Requirement: 2 questions, 10 answers
Usage patterns

• Do students use PeerWise voluntarily?
  – COMPSCI 101 course, UoA First Semester 2007 (530 students)
  – Requirement: 2 questions, 10 answers
Usage patterns
Student attitudes
Student attitudes

• Perceptions of the PeerWise activity
  – EngGen 131, UoA Second Semester 2007
  – Requirement: 2 questions, 20 answers
  – Likert scale survey (n = 439):
    • Developing new questions helped me learn
    • Answering other student's questions helped me learn
    • The ability to read and write comments was useful
    • I would like to use PeerWise again next year
  – Open-ended comments
Student attitudes

• Survey results (n = 439)

Developing new questions helped me learn

Answering other student's questions helped me learn

The ability to read and write comments was useful

I would like to use PeerWise again next year
Student attitudes

• Open ended comments
  – “What do you believe are the biggest benefits of using PeerWise?”
  – 279 written responses
  – Coded for themes – two most common themes:
    • “studying / exam revision” (35%)
    • “assists learning” (16%)
Student attitudes

• Open ended comments
  – “studying / exam revision”
Student attitudes

• Open ended comments
  – “studying / exam revision”

  “Good, more **interesting way to study**. Not a subject that is easy to sit down and work on before exams, Peerwise is a **good way to see how much you know**.”

  “The **variety of questions** that i encounter greatly prepare me for the exam”

  “The **large database** of peerwise questions provides a great resource for exam revision.”
Student attitudes

• Open ended comments
  – “studying / exam revision”
  – “assists learning”
Student attitudes

• Open ended comments
  – “studying / exam revision”
  – “assists learning”

“Learning about different topics; it is sometimes easier to learn if you have to think about each question, rather than simply being told in the lecture.”

“yes, because you learn from your mistakes.”

“useful for developing understanding and testing yourself”
Question quality
Question quality

• What is the quality of the student generated questions?
  – a high quality repository will be a better study/revision resource
  – CS1 course (taught using Java) at UoA First Semester 2008
    • 617 questions, participation only
  – We examined every 10th question
    • 61 questions
Question quality

• Examples
Question quality

• Examples
  – good questions
**Question**

Which of the following loops *could* you use to cycle through all elements of the following array *without* going out of bounds and causing the program to crash?

```java
int[] array = new int[] { /* array elements */ };
```

Assume that in all cases, `array[0]` is inside the square brackets.

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**Comments**

*Average rating: 3.93*

*Total responses: 108*

*Total ratings: 73*

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**Alternatives**

| Alternative | Percentage | Code
|-------------|------------|------|
| Alt A       | 5 (4.63%)  | ```
|             |            | int i = 0;
|             |            | while (i <= array.length - 1) {
|             |            | i++;
|             |            | // code
|             |            | }```
| Alt B       | 22 (20.37%)| ```
|             |            | for (int i = 0; i < array.length; i++) {
|             |            | // code
|             |            | }```
| Alt C       | 46 (42.59%)| ```
|             |            | for (int i = array.length - 1; i >= 0; i--) {
|             |            | // code
|             |            | }```
| Alt D       | 17 (15.74%)| ```
|             |            | for (int i = array.length - 1; i >= 0; i--) {
|             |            | i--; // code
|             |            | }```
| Alt E       | 18 (16.67%)| ```
|             |            | int i = 1;
|             |            | while (i < array.length) {
|             |            | i++;
|             |            | // code
|             |            | }```

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*Explanation*

Remember: 1) When created, the length of the array, or `array.length`, counts from a starting point of 0. This is the case, where we created an array with values 0-14.

Using `for` notation to loop through the array, with the first index of the array being 0, so every number from 14 to 0 is used. We can take advantage of this and initialize a counter to `array.length`, which means it can be used as the upper limit of the loop. The last index is 14, thus when it decreases by 1, it will not reach an out of bounds exception as it has been rendered in 'for'

We know that our array has values 0-14 which is correct for the question. If we check the index 0 it will stop

If we check index 14 it will completely cycle through the array and check index 0 it will stop completely through all values

We use the condition `i < array.length` to make sure that we will check correctly at 14 to prevent a condition stop this loop.
Question quality

• Examples
  – good questions
  – poor (but useful) questions
Question

What is the appropriate boolean variable following returns false:

!A || B && !B || A

Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>A =</th>
<th>B =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt A</td>
<td>False</td>
<td>True</td>
</tr>
<tr>
<td>Alt B</td>
<td>True</td>
<td>True</td>
</tr>
<tr>
<td>Alt C</td>
<td>False</td>
<td>False</td>
</tr>
<tr>
<td>Alt D</td>
<td>None of the above</td>
<td></td>
</tr>
</tbody>
</table>

Explanation

The Answer is A:
When A = False, B = True;
!A || B && !B || A =>
(True) || (True) && (False) || (False) => True && False = False

Comments

Check this page. && is higher than ||.
http://java.sun.com/docs/books/tutorial/java/nutsandbolts/operators.html

so the equation is A + B!B + !A, which becomes A + !A, which always evaluates to true.

So it doesn’t matter what values you put into A and B, the expression is never going to be false.

I think that the && operation has a higher priority and so will be evaluated before the ||
i.e. (!A || (B && (!B))) || (A)

haven’t double-checked in textpad though...

As explained by the person above me who linked to the sun page, as that expression stands, it cannot be false. In bracket form it would look like: (!A || B) && (A || !B).

Of the answers you gave, none of the above is the correct one. :P

Author’s reply

Sorry everyone. thanx for the reply. i’ve posted the new version of this question. Feel free to check it out n comment on it (i’ve ‘repaired’ my understanding, i hope i got it right this time :D)

ya && is at a higher lvl than || so always do && so in this case the answer can only be true no matter what

Wow that actually helped me alot lol. Totally forgot about the order of && and ||
Question quality

• Examples
  – good questions
  – poor (but useful) questions
  – questions improved by others
Question:
//What is the output?

```java
Point[] pts = new Point[10];
pts[0] = new Point(100, 200);
pts[1] = new Point(200, 300);
pts[2] = new Point(300, 400);
pts[1] = pts[2];
pts[2] = pts[0];
pts[0] = pts[1];
System.out.println(pts[0]);
System.out.println(pts[1]);
System.out.println(pts[2]);
```

Explanation:
```java
```

Haha, good question based off class example. \o/

However! The explanation is lacking.

It should be made quite explicit that when you make an assignment of one object equaling another object, that the pointer value is copied exactly at that moment in time. It does NOT create a link to whatever the object on the right side of the expression happens to equal after the expression took place.

I.e.,
If we say that:

Pts[0] points to a memory address starting at AA0000,
Pts[1] points to a memory address starting at BBAA00,
Pts[2] points to a memory address starting at CCBBAA,

Then when we perform the expression: Pts[0] = Pts[2]. we are saying copy the memory address in Pts[2] RIGHT NOW. So Pts[0] is now equal to CCBBAA.
If we then say Pts[2] = Pts[1], then Pts[2] changes memory address to: BBAA00.

**Pts[0] does not change.** It is still equal to CCBBAA.

**Author's reply**
Yep, entirely based on the confusing class example!

Btw, thanks for the detailed explanation!

Hopefully this helps the other members that are still confused after my pretty vague explanation (sorry! XD)

the first two options are the same!!! and I still don't understand why my answer of A or B is wrong after reading the explanation provided by the writer

The explanation is not good enough, it is very confusing
Question quality

• Results
Question quality

• Results
  – 11% of the questions (7 of 61) had incorrect answers
  – In all cases these errors were discovered
Question quality

• Student perceptions of quality
  – How effectively do students rate questions?
  – Can students avoid poor quality questions?

• We rated questions on the same scale (0 – 5)
Question quality

- A strong positive correlation, $R = 0.54$
Question quality

- Students use the ratings to decide which questions to answer
Efficacy
Efficacy

• Do more “active” students perform better in exams than less “active” students of similar ability?
  – We need a measure for “activity”
  – And for “ability”

same initial “ability”

most "active"  least "active"

exam marks  exam marks

difference of means
Efficacy

• We can measure “activity” in several ways
  – Q
    • the number of questions a student contributes
  – A
    • the number of questions a student answers
  – C
    • the total character count of all comments a student writes
  – D
    • the number of days the student is active with PeerWise
  – CM
    • a combined measure of all four of the above, based on sum of deciles
Efficacy

• How do we measure initial “ability” (prior to using PeerWise)?
  – mid-semester test mark
  – group students by quartile

![Answer and Question Graphs](chart.png)
Efficacy

• Results
  – using “CM” (the combined metric)

All differences significant at 5% level
Problems

- We are still learning
Problems

- We are still learning
  - High participation requirements don’t work well
Problems

• We are still learning
  – High participation requirements don’t work well
• One course required 2 questions per week

“How about 2 questions for every two weeks...? Seriously need more time to actually study”

“Having to contribute two questions per week is discouraging – i’m only willing to put so much time towards peerwise”

Developing questions on PeerWise helped me learn

Answering questions posted by others on PeerWise helped me learn
Problems

• We are still learning
  – High participation requirements don’t work well
  – Some students lack faith in peers’ contributions
Problems

• We are still learning
  – High participation requirements don’t work well
  – Some students lack faith in peers’ contributions

“In order to maintain a high standard of questions, the posted questions must be reviewed by staff and then be approved. In this way all the questions would be very useful.”

“It’s hard to know how good these questions really are/how indicative they are of the standard we are expected to know. i.e. without the questions being rated by STAFF members.”
Future work

• Creating larger communities
  – Involve students at multiple institutions sharing the same repository

• Randomized controlled trial for efficacy
  – Underway with CPSC and BIOL at UBC

• Feedback from instructors
  – What is needed?
Thank you

• Questions?
  – I am in room 215 of CS building
  – Email: paul@cs.auckland.ac.nz
  – Also feel free to talk to Rosie Redfield (Life Sciences Centre)

http://peerwise.cs.auckland.ac.nz