Creating an Open Certification Process

Cem Kaner, J.D., Ph.D.
kaner@kaner.com

Tim Coulter
tcoulter@fit.edu

Florida Institute of Technology, Department of Computer Sciences

Abstract

This paper reports our progress in developing an open certification system for software testers.

Open certification involves examinations developed by the professional community, published under a Creative Commons license, and subject to public critique. The process creates a diversity of exam types, reflecting the diversity of opinions in the professional community about what is important and what is good practice. Exams are computer-scored and free. When a candidate takes an exam, feedback includes the designated-correct answers along with the critiques stored for each answer. This provides a context for discussion. For example, suppose an employer administers this exam during an interview. After the exam, interviewer and examinee can discuss the questions and answers—this should be far more revealing than the raw score. Examinees who gave thoughtful "wrong" answers can demonstrate the worth of their answers.

This type of certification is particularly important for testers because they make up a large portion of the software engineering workforce, but there is no generally accepted credential for this type of work. Industrial certifications have been put forward (some at great profit) but as measures of knowledge or skill, several practitioners consider them inadequate. The open process acknowledges the controversy of the simple answer and honors the desirable tendency of testers to challenge everything.

Software testing is hardly the only subfield of CS/SE/CIS plagued with popular commercial certifications that assess examinees at low levels of the Bloom taxonomy but market the image of the examinee who passes as an expert (or at least, as someone who has a practical clue).

The structure we create for testing is generalizable to many other fields. Populating that structure with assessment and study materials will take substantial work, but for a group interested in doing that work, we have a model that is open source and available for free extension.

Contents

1. Introduction for SIGCSE

2. Overview and broad architecture of the project

3. Project manager's perspective: Problems with the current system

4. Abbreviated use cases

5. The Senior Project materials

1. Introduction for SIGCSE

This is a working document, which we use to help set a context for:

- Development of the *Test Question Server* by members of a Senior Project Team (undergraduates) at Florida Institute of Technology;

- Development of a pool of test questions, by participants in the original *Workshop on Open Certification* (see www.freetestingcertification.com) and participants in the *Black Box Software Testing Instructor's Course* (hosted at http://www.satisfice.com/Moodle);

- A project evaluation team (offering bug reports and feature suggestions while working with the software) of volunteers who participated in the *Workshop on Open Certification* or who have joined the project since;

- Developers / maintainers of the *Black Box Software Testing Course*, a Creative Commons set of free course videos and assessment materials, co-hosted at *http://www.testingeducation.org/BBST* (all videos and some assessment materials) and *http://www.satisfice.com/Moodle* (free public course) (all materials)

- Developers of the *Testing Course Instructional Materials Wiki*, which kicked off at the February 2007 Sixth Workshop on the Teaching of Software Testing and is in very preliminary shape at http://cs.fit.edu/~ckaner/csterwiki/index.php/Main_Page;

- Future developers of the *Examination Server*;

We intend to write an academic document that reviews the industrial certification literature, the state of software testing certification, and the relationship of this work to that context— however, this is not that paper.

This is an informal report that pulls together work in progress and ideas discussed at the workshops and project websites.

For the SIGCSE reader, what we offer here is:

- Early notice of an examination/certification structure that will probably mature in about 3 years.
  - o Undergraduates and students from outside the USA often ask faculty whether they should pursue industrial certification along with their degree, whether that will make them more employable.
  - o We don't know what the ultimate value of these certifications is. What we do know is that this project is serious and the exams will be free (which fits well with student budgets).

- Illustration of a work-in-progress that involves undergraduates collaborating with professionals in the field. This is a different type of service learning from the common small website or database for a nonprofit. Here, the students carve out a piece of a bigger project and are supervised by stakeholders who can offer technical guidance as well as a customer perspective.

- Perhaps an opportunity to collaborate on the further development of this project or extension

to another domain.

Note to Potential Collaborators

Academic projects often come with funding. This one does not.

We will certainly welcome donations and we have plans to approach corporate sponsors after we reach some project milestones—after we can demonstrate value and likelihood of success—but if you are considering joining us, you should assume that we will be operating on a shoestring budget.

2. Overview and Broad Architecture of the Project

The Concept of an Open Certification

In an Open Certification project, "Open" has a variety of possible meanings, which we embrace:

Open to the public

- Anyone can register on the system for free. In all comments below, "anyone" means "anyone who is registered on the system."

- Registration will require an identity check—we will not accept anonymous or pseudonymous postings.

- Participants will be require to follow some basic terms of use in the system. For example, comments posted must not include foul and abusive language. Participants who do not follow the rules can be banned from the system.

Open source

Everything published at the site is Creative Commons licensed. Most requires attribution (acknowledge authorship) but some will look more like collective wiki authorship, in which the final product is an amalgam of edited contributions by many people.

Open questions

- For now, all questions are "objective" (computer-scorable). This allows us to minimize the cost of administering the exam, making it feasible to offer the exam for free.

- All questions in the question database are visible to the public.

    o We have seen with other widely administered exams (in software testing and more generally) that several people memorize the questions while they write an exam, then post the questions to mailing lists or web sites. Many people who are preparing to take the exam themselves consult these lists of questions/answers and have an advantage if the exam they take includes some (or all) of the same questions.

    o Rather than calling it cheating to consult such information, our objective is to provide the same information—full information—to everyone.

- Anyone can comment on a question and its grading scheme.

    o System editors will occasionally reorganize a comment set to clarify and eliminate redundancy.

- Anyone can create a question, so long as they follow our structural, annotating and referencing rules. All questions are signed by the author. Only the author can revise a question.

- Different authors can create identical questions with different designated-correct answers.

Open exams

- An exam is a random stratified sample of the pool of questions.

- In creating an exam, an exam author can weight some topics heavily (more questions appear on those topics), designate preferred individual questions, and block other questions or topics.

- Different exams will reflect different visions of testing.

    o Some employers will author custom exams for use in interviews at their companies.

- There must be enough questions in the pool to support the exam. For example, if there are only 20 questions on performance testing and all of them would always appear on every performance testing exam, the system is not yet ready for a performance testing exam.

- Exams are subject to review for redundancy with other exams, quality of description of the exam, and sensible selection of question (for example, it is unlikely that one would legitimately include two versions of the same question, differing in which answer is scored correct).

Open body of knowledge

- Exam authors can publish study guides with their exams.

- We may or may not host a blog-like system that exam authors can use to create / publish / update their study guides. We may instead encourage them to create something at their own website and link to it from the open certification system.

- Whether a study guide is published at the Open Certification site or elsewhere, parts of it will probably be quoted or cited in the comments on individual questions.

- It is appropriate (within our expectations and terms of use) for one registered user of the system to publish a detailed critique of the body of knowledge posted by anyone else.

Open / free references

- Authors must justify questions and answers, and critics justify comments, by linking to credible free-access documents on the Web.

- The insistence on free-access references is controversial and may not last. Our reasoning for this requirement:

    o This is an internationally available project. Many of the stakeholders have limited access to the commonly cited books.

    o When an examinee takes the exam in a high-stakes situation (e.g. job interview), we want to encourage the examinee and interviewer to look over the answers and the comments on them at our site. A thoughtful wrong answer will often show more wisdom and knowledge than an answer that matches the answer designated as correct. The comments on a given question will often be terse, with pointers to longer or more thorough statements. In the course of this discussion, we want to enable /encourage people to check these references. It is realistic to expect them to be able to access

web-based sources but not to expect them to access a huge library of books.

- o There is a remarkable selection of high-quality materials on the web.

Free exam administration

- Examinees will log on at the open certification site and pick the type of exam desired.
  - o For example the examinee may pick an exam that focuses on the views/needs of a specific company, or one that focuses on a specific topic (such as performance testing).
- The software will select an appropriate set of questions, present a form (the exam) that the user fills out and submits, and score the exam.

Exam feedback intended to promote reflection and discussion

- When someone writes the exam, the feedback they receive includes the list of questions, their answers, and the discussion associated with each of the questions.

The Broad Outline or Architecture of the Open Certification System

Question server

- This provides the database and user interface for creating, updating and annotating exam questions.

Exam server

- This provides the database and user interface for
    - Creating, updating and annotating exam types
    - Selecting an exam type and generating a user-fillable exam form
    - Grading a submitted exam and providing user feedback
    - Displaying a user-printable certificate
- We may split this into an exam preparation server and an exam administration server.

Course servers

- The availability of free courseware seems implicit in the idea of free certification.
- Several teachers of software testing courses have posted materials on the web.
- Kaner and James Bach have been developing a course in black box software testing that can be the basis for some certification exams.
    - The *Black Box Software Testing Course*, a Creative Commons set of free course videos and assessment materials, is co-hosted at *http://www.testingeducation.org/BBST* (all videos and some assessment materials) and at Bach's site *http://www.satisfice.com/Moodle* (free public course) (all materials)
    - The video lectures are also at Google Videos
- A free instructor training course is underway now (2007) at **www.satisfice.com/Moodle**
- **We expect / intend to encourage others to create their own online courses and post them. Within limits (this takes a lot of work, at some point compensation has to come into play), we will help them. The goal is not to create a certification around the Kaner/Bach course and call it "Open Certification." The goal is to create a family of certifications around a family of diverse-opinion materials.**

Study materials site

- The *Testing Course Instructional Materials Wiki* kicked off at the February 2007 Sixth Workshop on the Teaching of Software Testing.
    - As of this writing (March, 2007), it is in very preliminary shape at http://cs.fit.edu/~ckaner/csterwiki/index.php/Main_Page

- The goal is to pull together links to instructor-useful materials on testing, classroom activities that could be applied to testing courses, assessment materials/ideas that could be applied to testing and so on.
- We expect that this site will mature into a form that is navigable by people who are interested in studying testing, but it is primarily there for people who are developing testing courses or certification exams.

Other Sub-Projects

Question development and review

- We have a small selection of draft questions (perhaps 100 so far) and expect the 2007 Open Certification workshop to kickstart the exam question process

- The open certification exams are computer-scorable. We face the same difficulties in constructing questions that reach beyond memory work and simplistic application as everyone else. However, we think the open certification exam *process* encourages a deeper level of study and discussion.

- Once the question server is running, we expect broader input from participants in the original Workshop on Open Certification (see www.freetestingcertification.com) and participants in the Black Box Software Testing Instructor's Course (hosted at http://www.satisfice.com/Moodle)

Project evaluation team

How could a project to develop courseware on software testing not have a test team?

The bug tracking server is at http://www.opencertdev.com:8081/trac/OpenCertification

The evaluation team files reports of design errors, wished-for features, and coding errors. Many of the use cases (abbreviated into user stories) have been filed as bug reports.

3. Project Manager's Perspective: Problems With the Current Certification System

By Cem Kaner

Background: Why do we need a certification?

On a typical software development project, 20% to 60% of the staff are likely to be software testers (people whose primary task is testing or "quality control" in some broader sense).

In the United States (worldwide, as far as we know), there are no undergraduate degree programs in software testing. A few colleges offer Associate degrees in testing; a few graduate programs offer M.Sc. specializations in testing, but the total graduating pool is very small.

Many computer science programs don't even offer testing courses or offer courses that are inapplicably theoretical, Others offer courses that teach programmers how to test their own code—these are critically important skills, but this is often *not* the type of work done by people whose job description is *Tester* (of someone else's code, often of binaries only).

Florida Tech requires undergraduates in software engineering to study black box software testing in one course and programmer testing in a subsequent course. Our impression is that it is rare for software engineering or computer science programs to offer more than one testing course.

We see no reason to expect a substantial change in the depth of software testing instruction at American universities over the next decade.

The absence of academic credentialing doesn't eliminate the market for credentials. It just means that people will look outside the academic system for them. As a result, several competing commercial providers have come forward to offer their own credentialing systems.

Industrial certification

The typical certification involves a combination of a few days of classes and a not-very-hard exam. Most of the exams / study guides that I have seen involve relatively easy questions that assess the candidate's knowledge at low levels of Bloom's taxonomy, emphasizing memorizable definitions or distinctions between concepts or very simple applications.

Certification exams are offered by:

- Professional societies, such as the American Society for Quality (ASQ), http://www.asq.org/certification/software-quality-engineer/

- For-profit corporations, such as the Quality Assurance Institute (QAI)

- Entities formed specifically to create / administer these exams, such as the International Software Testing Qualifications Board (ISTQB) and national affiliates (American affiliate is ASTQB).

Certification exams offer significant profit potential

- ISTQB charges $250 for a 40-question multiple choice test. According to Linz, Schaefer & Spillner in *Software Testing Foundations, Second Edition*, more than 40,000 people took the ISTQB Foundation exam over a recent 18-month period.

- ASQ charges $360 for a 75-question multiple choice test.

- QAI charges $350 for a mixed multiple-choice and essay exam (we understand that this is nonprofit for QAI because the fee compensates essay-exam graders who are not necessarily employees or officers of QAI).

These organizations, or organizations that are often closely related to them, typically offer training courses that prepare students to take the exam.

- ASQ charges $1800 per person for a basic 5-day software quality course.

- QAI charges $895 for a 2-day exam prep course

- Private organizations pay ASTQB about $4000 for 3-years' right to offer the Foundation Training Course and typically bill about $2000 for a 3-5 day exam prep course.

- Some organizations offer certification based on taking a series of courses, without a formal certification exam. For example, the International Institute for Software Testing (IIST) offers the Certified Software Test Professional certificate on completion of 10 one-day courses ($395-$495 each).

Industrial certification marketing

Much of the marketing of these certificates is very aggressive. Reading the brochures and listening to the speakers, one gets the impression that someone who is certified is knowledgeable, skilled, and sophisticated enough to make complex decisions wisely.

What does it say about a profession if you can (allegedly) become an expert in that field with a few short courses and little or no industry experience? Over the long term, how does acceptance of this type of certification impact the respect others have for the field?

> "Certification from ASQ is considered a mark of quality excellence in many industries. It helps you advance your career, and boosts your organization's bottom line through your mastery of quality skills. Becoming certified as a Software Quality Engineer confirms your commitment to quality and the positive impact it will have on your organization."
>
> American Society for Quality
> http://www.asq.org/pdf/certification/inserts/csqe-insert-2006.pdf

> "Why become certified? As the IT industry becomes more competitive, the ability for management to distinguish professional and skilled individuals in the field becomes

mandatory. Certification demonstrates a level of understanding in carrying out quality assurance principles and practices. Acquiring the designation of Certified Software Quality Analyst (CSQA), Certified Software Tester (CSTE) or Certified Software Project Manager (CSPM) indicates a professional level of competence in the principles and practices of quality assurance in the IT profession. CSQAs, CSTEs and CSPMs gain recognition as software quality profession, achieve potentially more rapid career advancement, and gain greater acceptance in the role as advisor to management."

<div align="right">

Quality Assurance Institute
http://www.softwarecertifications.org/qai_overview.htm

</div>

"By becoming an ISTQB certified tester, you will distinguish yourself as someone who knows how to apply sound software testing techniques. We have designed the Foundation and Advanced certification programs to help you identify yourself to your employers and clients as a true test professional one who studies the field, applies fundamental and sophisticated test techniques, and understands the important issues. As a software test professional, you will be qualified to help project and technology managers make important decisions that balance quality, feature, schedule, and budget considerations. As a software test professional, you will be able to detect defects that others miss and save your employers and clients from costly and embarrassing field failures.

"Through the involvement of the world's foremost experts in software testing, drawing on National Boards around the world that collectively bring 1,000 years of software testing experience to the task, the International Software Testing Qualification Board has developed, and continues to refine, the Foundation and Advanced certificates. We invite you to prepare yourself for an exciting career in software testing and to use these certificates as steps on your career ladder."

<div align="right">

American Software Testing Qualifications Board
http://www.astqb.org/

</div>

"Become an Expert – Earn a Master Certificate!

"Want to make an impact in business today? Expand your knowledge while preparing for industry certification! Stay current on industry trends and technology by earning your master certificate online — the surest and fastest way to gain professional expertise along with the most in-demand skills that can be used right away.

"Obtaining a master certificate demonstrates thorough software testing understanding as well as a solid commitment to continuing education. The three eight-week courses in the master certificate track provide valuable skills and credentials that can be applied immediately on the job.

"Get Certified!

"If you think continuing education won't impact your income, consider this: Industry recognized certification helps professionals boost their salaries by 16%, according to the 2005 salary survey by *Certification* magazine. The courses in Villanova's Software

Testing program prepare you for certification from the ISTQB®. By becoming an ISTQB Certified Tester, you will distinguish yourself as someone who knows how to apply sound software testing techniques and principles to reduce defects, improve quality and enhance business success. Certification acknowledges that you have mastered the newly-acquired subject matter and demonstrate a commitment to professional excellence. You'll come away with a feeling of prestige , respect and accomplishment by earning a Villanova master certificate and obtaining the stature associated with industry certification.

Villanova University
http://www.villanovau.com/Content/SoftwareTesting.html
http://www.universityalliance.com/info1/UA_PDFs/Villanova/T2-
Disciplines/Villanova_SoftwareTesting_T2.pdf

The Testing program at Villanova is part of their participation in the University Alliance, which presents online courses to a wide range of students. We were intrigued by Villanova's description—and its $4995.00 price tag—so we took advantage of their Chat Online feature. Tim Coulter, Rebecca Fiedler and Cem Kaner collectively asked a set of questions.
The Villanova brochure for software testing points out that "Villanova University is accredited by the Middle States Association of Colleges and Secondary Schools." So we asked, "Is this program accredited?" Villanova's representative said "Yes. Regionally accredited. The highest accreditation a school can get."

> o *This is confusing to us. According to the web page of the Middle States Commission on Higher Education,*
> *http://www.msche.org/?Nav1=About&Nav2=FAQ&Nav3=Question03, "When an institution plans to offer at least 50% of a program through distance learning, it must receive advance approval from the Commission to have those programs included within the scope of the institution's accreditation."*

> o *When we look up Villanova's accreditation status record at www.msche.org, we see that Villanova is "approved for the following [Distance Learning] program(s): Master's Degrees in Civil, Mechanical, Electrical, Computer and Chemical Engineering; Ph.D. in Nursing."*

> o *There appears to be no indication in the Villanova Statement of Accreditation Status at www.msche.org that Villanova is accredited to offer the testing certification program online.*

We also asked:

> o *"Do I need this [certificate from Villanova and ISTQB] to get a job as a software tester"*

The response was:

> o *"Yes—especially if you have no experience."*

What does it say about a profession if you can (allegedly) become an expert in that field with a few short courses and no industry experience? Over the long term, how does acceptance of this type of certification impact the respect others have for the field?

The exams

The certification exams vary.

- IIST's certification is based on 1-day courses. At the end of each course, you take an essay exam and must earn 80% to pass.

- QAI's certification exams include a mix of multiple choice and essay exams.

  I am not yet aware of studies of between-grader reliability in the grades assigned by IIST and QAI. At Florida Tech, we recently completed a study in which 8 practitioners and academics blind-regraded final exams from several teachings of the same course. Their task was to rank answers to a question from best to worst. The goal was to see if later teaching methods were more successful than earlier (as measured by exam performance). The result was surprising. I gave grading instructions for each question that were perfectly clear (to me) and no one called to ask what the instructions meant. But correlations between graders were very weak; a few were even negative.

- ASQ and ISTQB exams are multiple-choice.

Consider the following multiple-choice question (from one of the exam's study guides):

> **In prioritizing what to test, the most important objective is to:**
>
> **1. find as many faults as possible.**
>
> **2. test high risk areas.**
>
> **3. obtain good test coverage.**
>
> **4. test whatever is easiest to test.**

The supplied-correct answer is (2).

My critique:

The colleagues I respect most see testing as an empirical investigation, a service that provides stakeholders with quality-related information about the software under test. In terms of prioritization, the primary objective of this service must be to meet the information needs of the stakeholders.

The question presents a factual statement (the most important objective is X) but in practice, in different situations, (1), (2), (3) and (4) have each had their turn as the most important objective.

The answer that we would argue is correct (any of these could be most important, depending on context), is not even an option.

While appearing to call for a simple factual response, the question is actually presenting someone's opinion about how to test, while assuming (without stating) the conditions under which this opinion would be correct.

Here's another example:

- Here's another sample question:

Which of the following requirements is testable?

1. **The system shall be user friendly.**

2. **The safety-critical parts of the system shall contain 0 faults.**

3. **The response time shall be less than one second for the specified design load.**

4. **The system shall be built to be portable.**

The supplied-correct answer is (3)

My critique:

> *In a Requirements course, if any of these would be considered correct, it would probably be (3), but this is not a Requirements exam, it is a Testing exam. Pay attention to the fundamental difference between requirements specifiers and testers. Specifiers control what the specification says. Testers do not. If you tell a specifier that part of the spec is untestable, s/he fixes the specification. Say the same thing to the tester and you are saying that s/he cannot test it (untestable) until it is fixed..*

> *Answer (3) is arguably **untestable** because "design load" probably doesn't specify the caching settings or other performance-critical configuration information about the system under test.*

> *Answer (1) **must be** testable, because we have a whole field called **usability testing** that exists for the assessment of user-friendliness. If you couldn't test weakly specified systems for user-friendliness, you'd almost never get to do usability testing.*

> *The assumption that underlies this question is that a requirement is untestable if it does not specify an oracle, but it is a very controversial question in our field whether you can test without a pre-agreed fully detailed oracle. In practice, testers almost never test with the benefits of such an oracle, therefore any question that insists on such an oracle must be incorrect.*

> *In our view, calling this specification untestable is giving the tester an excuse to refuse to test a product or test poorly when s/he would be better served (more respected and less likely to be fired for incompetence) by doing the best testing possible with the product as it is.*

Unfortunately, in a computer-scorable exam, there is no room to argue these issues. Even if you allow students to make side-notes to challenge the wording of a question, in my experience, few do, partially because it is so awkward.

In our view, meaningful assessment operates congruently with the collection of knowledge, attitudes and skills it is intended to assess.

Software testers are professional skeptics. To require them to adopt a compliance mentality, in which they set aside issues of ambiguity, oversimplification, unstated assumptions or

controversial conclusions in order to provide the answer expected by an examiner is to demand conduct so far removed from what testers <u>should do</u> as to be invalid on its face.

The body of knowledge

Certification is normally done against a standard of some sort. Each of the certifiers has thus developed a body of knowledge that lays out what is to be known for the exam.

The expectation is that people will know what the body of knowledge says about a topic, and for examination purposes, they will echo that back to the examiner.

We have two concerns:

- First, the software testing field has not settled into a shared set of definitions, principles and practices. There are very strong differences of opinion even about the basics. These carry even into disputes about the definitions of fundamental testing terms, such as "test case" (is it inherent in the idea of a test case that you are testing against a prespecified expected result?), about the basic mission of testing and prioritization of tasks, about the appropriate / useful relationships between a test group/effort and other groups in a project team or company, about the definitions and proper use of some of the most common techniques, and so on. To make this clear to the academic reader, even the collection of definitions published in IEEE standards is typically ignored by leading practitioners, not because they don't read standards but because the practitioners don't respect the collection as either, authoritative or correct. (Of course, which definitions are seen as *incorrect* varies widely.)

- Second, the particular groups who are writing bodies of knowledge seem to be pressing some very conservative views. Several are so traditional that I considered the same ideas dated when I started writing the first edition of *Testing Computer Software* as a response back in 1983. The conservatism of these materials fosters a conservatism in the courses and so in the attitudes of the trainees. In a field as rapidly changing as computing, for a service provider to be this conservative is a liability.

The refrain that we often hear is that to be a mature field, testing needs to settle on a single set of definitions, practices, priorities and so forth—a single body of knowledge. Under this banner, we see bodies of knowledge, courses and books that promote a single viewpoint without acknowledging that there is serious controversy.

The pool of people who have started working on the Open Certification project—and I believe, the much broader group who are attracted to the Association for Software Testing—hold a different view. Maturity, we think, has more to recognizing and accepting that the world is a complex place and learning how to function well within that complexity. Insisting that the world be less complex will not make it so.

Rather than impose a common body of knowledge, the Open Certification project embraces the diversity of the field.

4. Abbreviated use cases

At the Workshop on Open Certification, and in follow-ups, participants developed a large set of design notes. These were collected and edited by Rebecca Fiedler and Erkan Yilmaz. Their notes are copied from a wiki built into the Open Certification planning site hosted at www.satisfice.com/Moodle

These notes have since been copied into our Trac server, a few more have been added and there is more discussion on some of them.

- The tracking server is at http://www.opencertdev.com:8081/trac/OpenCertification

- To add a new story, open a new ticket and select "feature" as the type. Doing this will allow us to track progress on each story, and set milestones for when we'd like to get them finished.

You can learn more about Trac by following this link: http://trac.edgewall.org/

The following are sorted by the role of the user:

Examinee or Self-studier

- I want to be able to exclude questions based on specific criteria (NOT anything from John Doe, NOT anything from gaming industry) --Becky

  - I would like to have a random selection of questions. Possible scenario: if I am not new to testing anymore or I would like to have never used exams. With this I can make my personalized, own exam format. --Erkan

  - I would like to have an option to exclude questions I already answered (or perhaps mark them in a different color). --Erkan

- I want to be able to compare my performance to others. --Becky

  - I would like to know how long others took for answering this one special question or for the complete exam (of course anonymous information). This can be seen either before or afterwards. --Erkan

  - I also would like something like a personal highscore (only visible to me): remember tetris or other games? If I have a highscore, I try to beat myself always more. it gives you also personal competition. highscore could be: number of correct answered questions,... --Erkan

- I want to be able to print a pretty certificate with my results on the test. --Becky

  - The message on the certificate should be something like: "Yes, this person took some questions here" - wihout giving any info on performance. --Erkan

    - otherwise: when certificate is printed, then there can be also done misuse with it. So, if a certificate is printed, this should be saved somewhere, so other people can check this also. --Erkan

- positive/negative feedback, so all possible human SENSES get this info too:

  - after an exam/question, all senses of the participants should be activated. This will give him/her a better feeling, when being good or bad. Learning is more effective then.

  - hearing: play sound (e.g. a crash of a plane,...)

  - sight: only for the user: let the complete screen wave or something like this 🙂

  - sight: this could be also listed somewhere publically available for anyone like: a scrollbar telling: "userx has just finished very good this exam" and then the text disappears (of course when userx was bad, this should not be transmitted).

  - others, if technically managable

  - --Erkan

- I want to be able to print (to printer or pdf) a copy of my results, including correct answers and comments on each question. --Becky

  - I would like to get a recommendation on literature: imagine I have bad results, then I would like to improve in this topic. For this, probably the questions should have abstract keywords or referrences to literature. Then over time there can be associations/relations and then people can see, in which area(s) they lack. --Erkan

  - perhaps this can also be shown graphically: good areas: green, areas with more knowledge needed: red. So people, when first starting, have a white graph, and then their graph gets colored over time. So they have a goal: to fill the graph. I mean their goal should be learning of course. But this can motivate them, to do more exams/questions. --Erkan

  - I would also like these info to emailed me, perhaps I do not have a printer or I am in an internet cafe, where I can't save, or I do not have an USB-stick. --Erkan

- I want to be able to see the question along with the answers and comments in a preview. --Becky

- I want to search for questions by topic or test technique. --Becky

- I want to search for questions by style of question in combination with other criteria. For example, I want to find all true/false questions on domain testing by a specific author. --Becky

- I want to be able to use multiple key words. --Becky

- I want to be able to extract the questions that pass through my filters in tab-delimited format. --Becky

- I want to be able to generate a practice test according to specific criteria (e.g. number of questions, specific context or industry) --Becky

- I want to be able to view the authorship of a question. --Becky

- I want to be able to include difficulty ratings in my search criteria - including NOT. --Becky

- I want to be able to see the difficulty ratings on each question. --Becky

- I want to be able to see a top10 or recent posts. Reason: then I can participate with others on "hot topics" discussed at the moment and get feedback probably sooner. Could also be in RSS (well other things like podcasting or so would be great too). --Erkan

- While I am taking an exam or doing a question,it would be nice, if I could see, who else is working on the same topic. Advantage: I could ask this person, if I have questions (by chat?) or just exchange thoughts and start a discussion - isn't discussion what counts and where we learn best? Of course people should set this up in their settings (to be not disturbed). --Erkan

- I want to be able to search for content which has only text and/or audio and/or video and/or picture and/or links for learning more on the topic. --Erkan

  - sounds perhaps still old fashioned: if I have an exam as audio book or podcast, etc. I can use this also on the go in the car or on an mp3-player, while doing sports. Format like: 1. question PAUSE 2. answers are listed PAUSE (user can think and decide) 3. and then later the correct choice(s) is given with the explanations. (OK, would take more effort to create audio-content, but ...) --Erkan

- I want to get notified, if someone adds a comment, makes a change to one of my interests (interest can be e.g.: subscribed questions or issues where I added some comments,...). This can be send by email or to my user-page in this group (like in wikipedia) --Erkan

- I would like to add buddies, if I feel that someone has made good contributions, I would like to get to know him/her more (of course if (s)he accepts). With this the users can see each other, when they are online and discuss on new questions together. --Erkan

- I would like to get a howto, when I register: e.g. short introduction in the system, how I can create my own exam,... . --Erkan

- I would like to have an option to report someone, when recognizing an abuse against policies of this group. --Erkan

- I would like to have an option to report, if I feel that this question is similar to another one or the same (also reviewers make mistakes ☺. Then both either get merged or one gets deleted. --Erkan

- I would like to have an option: to report, if this question was really good for me, it was confusing or not. This could go to the question reviewers to identify problem areas. In general the quality of the system would increase. --Erkan

- I would like to have emailed questions in a certain time-interval. Of course this is not suitable for exams, but for people who want to have a question per day (for distraction 😊) --Erkan

- save of the answers so far:

  - sometimes I have a bad internet connection and then my edits are lost. So, either there should be displayed a save-button or perhaps the system can do an auto-save? --Erkan

  - also perhaps I would like to continue on another time. --Erkan

Examiner

- I want to be able to exclude questions based on specific criteria (NOT anything from John Doe, NOT anything from gaming industry) --Becky

  - should be also possible to make a random select --Erkan

- I want to be able to compare my examinee's performance to others. --Becky

- I want to be able to see the difficulty ratings on each question. --Becky

- I want to be able to include difficulty ratings in my search criteria - including NOT. --Becky

- I want to be able to print (to printer or pdf) a copy of the examinee's results, including correct answers and comments on each question. --Becky

- I want to search for questions by topic or test technique. --Becky

- I want to search for questions by style of question in combination with other criteria. For example, I want to find all true/false questions on domain testing by a specific author. --Becky

- I want to be able to use multiple key words. --Becky

- I want to search for questions by topic or test technique. --Becky

- I want to be able to extract the questions that pass through my filters in tab-delimited format. --Becky

- I want to be able to see the question along with the answers and comments in a preview. --Becky

- I want to be able to generate a test according to specific criteria (e.g. number of questions, specific context or industry) --Becky

- I want to be able to view the authorship of a question. --Becky

- I would like to have an option to report someone when recognizing an abuse against policies of this group. --Erkan

Question Reviewer

- I want to search for questions by topic or test technique. --Becky

- I want to be able to extract the questions that pass through my filters in tab-delimited format. --Becky

- I want to be able to see the question along with the answers and comments in a preview. --Becky

- I want to be able to view the authorship of a question. --Becky

- I want to be able to indicate difficulty ratings for questions I review. --Becky

- I want to be able to exclude questions based on specific criteria (NOT anything from John Doe, NOT anything from gaming industry) --Becky

    o also by random select --Erkan

- I want to be able to proxy my vote to another reviewer --Andy

- I want to be able to select / assign a question to a reviewer --Andy

- I would like to be able to provide feedback to the question writer (?ask for a clarification / improvement to question?) --Andy

- I would like to see, if there are still untreated questions. Otherwise the question submitter may get demotivated, if (s)he does not get feedback soon. Perhaps there can be used some escalation system? --Erkan

- I would like to know, if the question submitter has made this question up by him-/herself. If not, were the copyright limitations considered? This could be displayed as extra line somewhere (of course the question submitter has to fill this info before) --Erkan

- I would like to have an option to assign the question to literature, which is freely available. Also I would like to assign the question to some abstract keywords. With this, students can - when they fail a question - get more knowledge in the source itself (see above: at **Examinee or Self-studier**). --Erkan

Exam Reviewer

(most is a straight copy from the Question Reviewer list, I just substituted exam for question and replaced Becky's name with mine --Andy)

- I want to search for exams by topic or test technique. --Andy

- I want to be able to see the exam along with the questions, answers and comments in a preview. --Andy

- I want to be able to view the authorship of a exam. --Andy

- I want to be able to indicate difficulty ratings for exams I review. --Andy

- I want to be able to exclude exams based on specific criteria (NOT anything from John Doe, NOT anything from gaming industry) --Andy

- I want to be able to proxy my vote to another reviewer --Andy

- I want to be able to select / assign a exam to a reviewer --Andy

- I would like to be able to provide feedback to the exam writer (?ask for a clarification / improvement to exam?) --Andy

- misuse-checks:

  - I am not sure, if this should be grouped here: if I see, that the person doing the exam, needed just 3 minutes for 40 questions, I should get a special sign, because probably this person would be cheating. --Erkan

    - Perhaps this can be done automatically by the system? A mail goes out to someone telling to check this userx. --Erkan

  - I would like to see the evolution of the examinee, if I see something like: ok, 1 week before he did very easy questions and now (s)he is able to solve also these hard questions? --Erkan

Question Submitter

- I want to be able to take my name off the question if the reviewers change it too much. --Becky

- I want to be able to submit questions electronically. My submission should include the question, the correct answer, the distractors, and the question type. It should also include my name and a specific context, if applicable. --Becky

- I want to be able to track the status of the question I submitted as it goes through the review process. --Becky

- I want to be able to use multiple key words. --Becky

- I want to search for questions by topic or test technique. --Becky

- I want to be able to see the question along with the answers and comments in a preview. --Becky

- I want to be able to view the authorship of a question. --Becky

- I want to be able to exclude questions based on specific criteria (NOT anything from John Doe, NOT anything from gaming industry) --Becky

- After I have submitted a question, I would like to edit the question (before the reviewer acts on it). Reasons: perhaps I have a better answer, idea the next day or I have recognized an error and do not want the reviewer to waste time. --Erkan

  o I guess this is already implemented?I would like to have a preview-possibility before posting a question. --Erkan

- How about adding/submitting info to some difficult questions in other format than written style? E.g. as audio, video. Of course people than have to obey some rules (e.g. copyright). --Erkan

- perhaps later in the project: I would like to transmit questions also in other questions. --Erkan

- Is it possible to make something like an additional toolbar (or perhaps over context-menu) in the browser, so that question submitters + others can submit links to open source material while they are surfing? Then WOC could get more open source material (of course someone has to review these materials). Advantage: more links will be provided, because probably not so many people will directly add the link, perhaps later they forget and then the source is gone. --Erkan

Instructor or Professor

- I want to be able to include difficulty ratings in my search criteria - including NOT. --Becky

- I want my students to be able to print (to printer or pdf) a copy their results, including correct answers and comments on each question. --Becky

- I want to be able to use multiple key words. --Becky

- I want to search for questions by topic or test technique. --Becky

- I want to be able to export the questions that pass through my search criteria in a format that will allow me to use them in Moodle, WebCT, or Blackboard. --Becky

- I want to be able to extract the questions that pass through my filters in tab-delimited format. --Becky

- I want to be able to import questions I have exported from Blackboard, WebCT, or Moodle into the WOC database. --Becky

- I want to be able to see the question along with the answers and comments in a preview. --Becky

- I want to be able to generate a practice test according to specific criteria (e.g. number of questions, specific context or industry) --Becky

- I want to be able to view the authorship of a question. --Becky

- I want to be able to see the difficulty ratings on each question. --Becky

- I want to be able to compare my students' performance to others and print a clear and easy-to-understand report (to printer or pdf). --Becky

- I want to be able to exclude questions based on specific criteria (NOT anything from John Doe, NOT anything from gaming industry) --Becky

- me as professor: I would like to start some polls from time to time. I would like to see, how people like the features, topic,... . --Erkan

- me as professor: I would like to add some of the users to a special list of mine. reason: perhaps I invite students of mine from real life to the virtual world. Then I could act faster, when they have questions or I could see what they are doing/writing at the moment. --Erkan

- I would like to have an option, to see, where people right now at the moment - live - do an exam. Then I could "watch" them - not like big brother, but as a helping hand (of course the student should allow this option). When I see, that they mark a wrong answer (of course, if there is something like a wrong answer 😊), I would like to tell them: "Hey, are you really sure about that?" Remember how it is with animals? They learn better, if they get the info (info is here punishment mostly) at the time they do the error. --Erkan

  o Another option could be, that the student has a button, where (s)he can click. And then someone answers. Like in school, if I have a prob, I raise my hand and the teacher sees: Ah, someone needs my help." --Erkan

5.   The Senior Project Materials

What follows are the current working notes of the undergraduate team at Florida Institute of Technology who are developing the Question Server in Fall 2006-Spring 2007:

- o   Tim Coulter (project lead)
- o   Kevin Gall
- o   Peter Leuken
- o   Adam Zalko

Their development server is at http://www.opencertdev.com but access is restricted.

The bug tracking server is at http://www.opencertdev.com:8081/trac/OpenCertification.

The question server will be available at http://www.opencertdev.com but is not yet ready for public access.

Requirements Document for Version 1.0

Vision

cer·ti·fy.

v.

    To guarantee or endorse reliably.

cer·ti·fied.

v.

    To guarantee as meeting a standard.

Random House Unabridged Dictionary

Although common to the English language, the meanings of the above two words are often mistaken. For instance, what does it mean for one to certify, and what does it mean for one to be *certified*? In most industries, certification – the act of both certifying and being certified – means a lot; certification sets a standard that both employees and employers can effectively rely on. In Software Testing, however, certification means very little. Instead of being a way to increase the professional state of the industry – which, in our view, is dearly needed – certification has become solely a money making venture led by companies eager to increase their bottom line. We think this is bad for the industry*. We think we can do better.*

The OpenCertification project was set up to change the meaning of the word "certification" as it relates to the Software Testing industry. Certification will no longer be a process closed to everyone but those few who create it. Instead, certification will be an open process – an *open* certification – available to anyone at any time, where the integrity of the certification is based solely on the questions held within, and not of the popularity of the most widely known company. We want to increase the state of the practice. *We want you to help.*

The Open Certification Project Team

Project Overview

The OpenCertification system can be described as an online "test-taking and test-development tool" for professionals within the industry. Broadly, it allows users to create multiple-choice tests for others to take.

Each multiple choice test within the system represents a certification exam endorsed by it creator. Although endorsement is important for any certification, providing endorsement is not the primary goal of this system. Instead, the system will focus on ensuring that certification exams are meaningful and relevant to the industry. To do this, the system provides three specific tenets:

1) Openness. All exams and their associated questions and answers are open for anyone to view at any time. This allows users to critically evaluate an exam for the quality of its content rather than the popularity of its endorsement.

2) Non-anonymity. The certifications held within the system are expected to be created and discussed by professionals within the industry. By encouraging users to use their real names on the certifications and discussions they create, credibility of a certain question or discussion can be judged based on the credibility of its creator. Remember: High credibility ensures highly credible content.

3) Discussion. In order to allow a community of people to share their critical evaluations of a certain exam, every item related to an exam may be discussed by others. This ensures the ability to share many diverse ideas within the system resulting in high quality content.

The above three tenets represent the three points that together create a successful feedback loop. In general, these tenets allow users to know what a certain certification is, who is endorsing it, and how to provide feedback to make each certification better.

Challenges

The three tenets listed in the previous section provide many challenges for both theory and implementation. These challenges are listed below:

1) Cheating.

   Cheating will always be a factor for any test-based certification. Because this system will provide open certification exams that anyone can view, the issue of cheating becomes far more relevant.

   Cheating on any certification exam is a social problem that exists within human nature; it cannot be prevented via any technical process. With that in mind, most ways of preventing cheating require the test-taker to be monitored while taking the exam.

   The certifications within the OpenCertification system will be no different. Although a user can take any exam at any time, hiring managers should not trust the value of any certificate not issued within some formal monitoring process. There are many ways that this system will allow monitoring of certification exams; these ways will be described in a later document as the project progresses.

2) Privacy.

   To maintain integrity of certifications held within this system, users must be required to use their real names and real contact information when adding and submitting data.

   To reduce any privacy concerns while still maintaining some integrity, the system will require the user to enter their full name and email address when registering for the system. To increase certification integrity while still supporting user's privacy rights, the system will give users the option to provide additional data about themselves. This information includes, but is not limited to, the users place of work and academic credentials.

3) Ensuring Credibility.

   In order for certifications to be relevant and meaningful within the industry, the system must do everything it can to increase the credibility of those using it. Although the system can require certain information about users to show their credibility, there is no way the system can ensure a certain person has entered credible information. For instance, how can the system ensure that a user entered their real name when they registered? Because there is no practical way to this, the credibility of the system and its certifications will rely strictly on the credibility of it users.

Content Types
_____

Many items within the system represent real-life objects or ideas that can be thought of as separate types of content. These types are described below:

- Exams. An exam is the main object that most users will interact with. Each exam is simply a list of one or more questions that will be asked as part of the certification process.

  The creator of an exam does not necessarily create the questions held within. Instead, the creator is responsible for compiling a *list* of questions that together combine to become a relevant certification. Because of the open nature of the system, an exam may be viewed by any user at any time.

- Questions. A question is item on an exam that represents one specific inquiry needed to assess a user's knowledge of a specific topic. A question consists of a body containing the main inquiry, as well as any number of possible answers needed to satisfy that inquiry. When a question is added to the system, it gets placed into a "pool" that is available to all exam creators. Exam creators will then use this question as part of their own exam.

- Answers. An answer is the part of question that may satisfy the question's main inquiry. An answer has two parts: 1) the body, and 2) the credit. The body represents the proposed answer to the question; the credit represents the percentage to which this answer is correct. An answer may be between 0 and 100 percent correct, and more than one answer within a question may have the same percentage.

- Discussions. Discussions are the main vehicle for feedback regarding exams, questions, and answers. A discussion within the system is meant to be "wiki-like" in that any user can contribute to the discussion.

- Tags. A tag is a special content type that describes the "meta" characteristics of other content within the system. Specifically, a tag represents a certain characterization class for a piece of data. For instance, a question related to "performance testing on legacy systems" may be

given the tags "performance," "testing," and "legacy" to represent the type of data that question holds.

Content that should be "taggable" includes (but is not limited to) questions and exams.

- Revisions. Many items within the system are said to be "revisionable," or "revisionsed." This means that, if edited, the edits are placed in a revision history that can be viewed later.

Revisions themselves are not edited specifically; rather, they are created when a user edits content that is revisionable.

Content that should be revisioned includes (but is not limited to) questions, answers, discussions and exams.

Feature Areas

This section lists a variety of feature areas that are described in the sections that follow.

- Question Creation & Editing
- Revisions
- Discussions
- Navigation & Exam Editing
- Content Tagging
- Taking an Exam

A question within the system is simply an electronic representation of a multiple choice question. Users should be able to add new questions into the system and edit those that are already there.

Throughout this document, the following multiple choice question is used as an example:

Which of the following product requirements is testable?

1. The system shall be user friendly.

2. The safety-critical parts of the system should have 0 faults.

3. The system shall look great!
4. 90% of all response times will be less than one second.

For this example, assume answer #4 is correct.

The system will display the same question like this:

Testing Requirements

Edit | Last edited by Tim Coulter   **Revision History**

Which of the following requirements is testable?

1. The system shall be user friendly.
2. The safety-critical parts of the system shall contain 0 faults.
3. The system shall look great!
4. **90% of all response times will be less than one second.**

Note the important items in the above image:

- The question title ("Testing Requirements")

- The question body ("Which of the following...")

- The answers list.

- The correct answer (bolded)

- The author / person who last edited it ("Tim Coulter")

When both adding a new question into the system, and editing an already available question, these same important items are considered. First, the user must enter the question title and the question body, as shown below.

To make adding and editing easy, the system will provide a WYSIWYG editor ("What You See Is What You Get") for data input. The editor shown above is FCKEditor (http://www.fckeditor.net/) although an equivalent may take its place.

The user must also enter possible answers that are related to the question body. Each answer is given a credit score representing the percentage that answer is considered correct.

Answers

1. The system shall be user friendly. 0% ▾ Edit Remove

2. The safety-critical parts of the system shall contain 0 faults. 0% ▾ Edit Remove

3. The system shall look great! 0% ▾ Edit Remove

4. 90% of all response times will be less than one second. 100% ▾ Edit Remove

Add Answer

Revisions

Revisions constitute a way for users to track the progression of changes related to important items. Information such as what the change was, who made the change, and when the change happened are all important attributes.

Whenever a user edits a revisionable item such as a question, an answer, or a discussion, a new revision is created. Differences from the previous revision to the newest revision are highlighted to point out exactly what the change was. For instance, the word "product" was added to the question below.

Because some revisionable items can be edited by multiple users at the same time, there exists the possibility for race conditions. For instance, if two users were editing the same discussion on two different computers, and first user finished before the second, what would happen to the first user's edit when the second user finally finished? Would everything be overwritten? To prevent data mishaps due to race conditions, the system will perform something similar to optimistic concurrency control (http://en.wikipedia.org/wiki/Optimistic_concurrency_control). Specifically, if two users are editing the same item at the same time, the last one to finish editing will be presented with a dialog asking that user to merge their changes. This dialog will simply be a new page showing the first user's edit along with the data the second user was trying to submit.

Discussions

Discussions by themselves are very simple. Specifically, a discussion is a revisionable area within the system that any user can edit; it is meant to be similar to a Wikipedia article, except that the discussion refers to a specific content item rather than a certain phrase in an encyclopedia.

A discussion within the system will look like this:

There will be a separate discussion items for each question and exam. Discussions will have very light version "wiki formatting," allowing a one discussion to point to other content items within the system (see image on next page).

Discussion

Edit | Last edited by Tim Coulter

Revision History

Note: This question is a duplicate of **this one.**

From Wikipedia:

Software Testing is the process used to help identify the correctness, completeness, security, and quality of developed computer software. Testing is a process of technical investigation

Most navigation through the system will be a series of tabs located at the top of the page. The following is an example of possible navigation:

Each tab represents a specific page within the system:

1) The News tab represents a page containing news information about the OpenCertification project. This will be the main index page for the site.

2) The Home tab is the users home screen which they will only see if they are logged in. This will provide the user with a list of all questions and exams they have created, as well as a "watch list" to keep track of the questions and exams that they don't own.

3) The Questions tab will provide a paginated list of all the questions in the question pool. It may optionally provide a list of categories that will like to paginated lists of questions.

4) The Exams tab will provide a paginated list of all the exams in the exams pool. Like the questions tab, it may show categories that link to paginated lists of questions.

5) The Search tab will provide a search facility to search through both questions and exams.

The last tab, titled "Performance Testing on Embedded Systems" is a dynamic tab, meaning it is only displayed under certain circumstances. This specific tab would be displayed when the user is editing the exam titled "Performance Testing

on Embedded Systems." When the user navigates to this tab, they will see the "Performance Testing on Embedded Systems" exam exactly as if they were the person taking it, with the addition of a few extra features. Specifically, this page will allow the user to delete and reorder questions that appear on the exam.

In order to add questions to an exam, the user must only find a question in the pool that they'd like to appear on their exam. When viewing that question, a link will show up that allows them to add the question to the exam they are currently editing:

Which of the following product requirements is testable?

1. The system shall be user friendly.
2. The safety-critical parts of the system shall contain 0 faults.
3. The system shall look great!
4. **90% of all response times will be less than one second.**

Add This Question | Watch This Question

Note: The above listed navigation items imply feature areas that are not specifically listed within this document. This is because some items are either not specifically noteworthy, or need further planning in order to be documented.
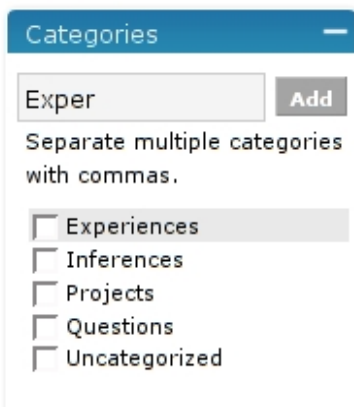
Content Tagging

In order to provide a categorization scheme that is useful to the user, the system will allow users to "tag" content as being part of a specific category. Wikipedia contains a great description of tags as they apply to web programs: http://en.wikipedia.org/wiki/Tags

Adding a tag to a content item will, in the very basic case, be a text box that accepts a comma separated lists of tags. In a more advanced case, the tagging interface may look like that of Wordpress, where a user enters a tag and the system provides recommendations for tags that have already been registered with this system. As an example, Wordpress' tagging interface looks like this:

Taking an Exam

When a user is taking an exam, it will look very much like pen-and-paper multiple choice tests. Each exam will consist of one page containing a list of questions and their associated answers. For each question, only one answer choice may be selected at a time.

After the user takes an exam, the system evaluates their answers based on the percent correctness of each answer. If the user achieves a percent correctness that is equal to or greater than a threshold determined by the exam creator, that user is said to have "passed" the exam. After passing, the user will be presented with a certificate showing that they have officially passed.

Note there are some implications providing an electronic certificate, such as the ability to counterfeit or reproduce them. To remove these implications, the system will always keep a record of every exam each user has passed.