

# 1 Foreword

Originally inspired by the Nordic Collegiate Programming Contest (NCPC), it has been held at NTNU every spring since 2007. The format is a five-hour contest with competing teams consisting of one, two or three contestants. A team of volunteer judges write the problems and answer clarification requests during the contest, while another team hands out balloons for each solved problem. Usually a rather hectic affair, it is extremely important that everything is well prepared. The number of teams is often more than 100, with the record being 162 teams in 2011

The contest system that verifies solutions is at the heart of the contest when it is in progress, and needs to be working perfectly at all times. The system must handle several submissions per second, while verifying that each one is correct and runs within the set resource limits. Submissions must show up on the high score list, and when problems are solved the team handing out balloons must be notified. In addition to this there were a lot of other functional requirements having to do with the bureaucracy of organizing the contest

A requirement was that new features could be easily added in the future, and the code was written with this in mind. The project will now become open source, and all programming contest enthusiasts will soon be able to request and implement their desired features

All aspects of this project have been pleasing and delightful for us. The team has exceeded all our expectations and their system will be used for years to come.

## 2 Preface

Before there were computers, there were algorithms. But now that there are computers, there are even more algorithms, and algorithms lie at the heart of computing. Designing a system for eager students to hone their skill in the heart of computing has been a true joy

Our group never wanted to settle for adequacy and mere requisiteness. For the past few months, weve taught ourselves a new programming language and framework and used advanced development frameworks - while tackling many social and technical conflicts.

We have ve proven how Ambition is a dream with a V8 engine, as Elvis Presley once said.

The group would like to thank our eager customers, Finn Inderhaug Holme, Christian Chavez and Christian Neverdal Jonassen for their time to meet us and provide constructive feedback. We also owe a big thanks to our supervisor, Hong Guo, for constructive criticism and reflections; without which, we would not ascertain the peak of our own potential

## 3 Introduction

### 3.0.1 About the course

Our group and assignment has been delegated as part of the course IT2901: “Informatics Project II” at NTNU. The work covers 15 course credits, equivalent to a 50% work position for one academic semester. IT2901 is offered only to those that are enrolled on the NTNU’s informatics BSc programme.

The primary purpose of the course is to let students apply their knowledge from other courses. This is rendered through a project for a real customer. The students have to communicate independently with their client, and deliver a software product that answers the client’s needs.

Grades are based on the satisfaction of the customers and an evaluation of the development process. The latter will be reviewed through written reports and timesheets, as provided in this document. Furthermore, it is important that students have met the gideadlines and documented their work in a structured manner.

### 3.1 The Group

The team consists of six members. All the members of the grare completing their BSc degree in Computer Science from NTNU in 2014. We had prior experience working together, and knew each other well. With many shared courses and similar interests, the team are all at a somewhat similar level of competence. However, we have different areas of expertise, and exploiting this has been a key to success on previous occasions. For a detailed description of each member, see the listing below.

**Anders Sildnes** Throughout his BSc, Anders has been taking courses related to algorithms and program security. Apart from his studies, he is developing for Engineers without Borders NTNU and spending time with open-source projects and other Linux tools.

**Eirik Fosse** Eirik has a primary interest in artificial intelligence and machine learning. In the course of his bachelor’s degree he’s focused on programming, mathematics, and evolutionary simulation.

**Filip Fjuk Egge** While achieving his degree, Filip has taken courses focused on a path related to system development and security. He has a varied education and knowledge on different aspects of computer science.

**Haakon Konrad William Aasebø** Haakon has selected disciplines related to mathematics and algorithms. Apart from being a student at NTNU he is playing football at NTNUI in the third division.

**Håkon Gimnes Kaurel** During his time at NTNU, Håkon has been keeping a primary focus on courses related to programming and the intersection between hardware and software. He’s also got experience as an app developer, and has extensive knowledge of the GNU/Linux operating system.

**Tino Lazreg** Tino has been taking courses related to different aspects of software engi, like programming, system architecture, human-machine interaction. Besides doing a BSc, Tino also works as a student assistant in a human-machine interaction course on NTNU.

## 3.2 About the Customer

Our customer is IDI Open. They are responsible for the annual programming contest mentioned in 1.2. Christian Chavez is our main contact for the project, but his two colleagues, Christian Neverdal Jonassen and Finn Inderhaug Holme, were also available for questions. They are all students of computer science at NTNU.

## 3.3 About the Contest

IDI Open is a programming contest where teams of up to three people meet and solve programming problems of various difficulty. The contest lasts five hours, and the objective is to solve as many problems as possible. The contest is open for all types of programmers, from students of all grades to professors and other professionals from the IT industry. Various prizes are gito the teams based on their performance. There are usually 8-12 problems in a contest. To make the competition fun for everyone, there are typically some problems that are easy enough even for novice programmers to handle. The main objective is to solve the highest amount of problems in the shortest amount of time.

## 3.4 Stakeholders

Our stakeholder fall into two different categories: the ones involved in the competition, and those involved in the course.

### 3.4.1 Course

**Supervisor** The supervisor's job consists of guiding and helping us through this project. This aid was primarily focused on the development process and the writing of this report. The supervisor tries to ensure that the developers communicate properly and have a structured approach to developing the end product. To verify this, we have had bi weekly status reports delivered to the supervisor, as well as regular meetings.

**Examiner** The examiner(s) is responsible for determining our final grade. Unlike the other stakeholders, we have not communicated with the examiner throughout the development process. Though, the examiner has got access to all the documents the supervisor has got access to.

### 3.4.2 Product

**IDI Open** The project's primary stakeholders. They are the host of the competition in which our product was used. Their inclusion in this product comprised all aspects of our project.

**Judges** The judges are hired by IDI Open to supervise the competition, service contestants and create problem sets. They will rely on our end product achieve the mentioned tasks. Throughout the process they have given feedback to our customers, IDI Open, about our product. Naturally, the judges are important to the contest, so it is important that they are satisfied with the software they have to use.

**Developers** The developers are responsible for satisfying all other parties. Similar to the customer, our involvement in this project is total.

**Maintainers** As IDI Open is an annually recurring event, our end product, if successful, will be used for many years in the future. At a point, we assume the code will need to be replaced or modified. Assumably, there will be another developer team to do this. As such, the quality of our product will impact them.

**Sponsors** Different companies sponsor each contest. In exchange for money and services, the sponsors get exposure through ads on the website and get to give a short presentation during the awards ceremony. Naturally, the sponsors want to associate their name with a successful product. Therefore, the sponsors rely on that contests are successful - this is heavily based on our product.

**Contestants** The actions of contestants are all through our software; our product will be their medium to take part in IDI Open. Reliability and usability is key to keep the contestants happy. The contestants also gave feedback to the customers about their user experience. Thus, how satisfied the contestants are impacts the developer's evaluation.

## 3.5 Goals

The goal of the project is to upgrade and improve the existing system used in IDI Open. We were given sole responsibility for our project; no other team or organization of developers has had responsibility for our solution. This gave us inspiration to do the best we could, and to give the customer something both we and they could be proud of for many years to come. And if the product is good enough it would hopefully also be used in larger programming competitions, maybe even international ones.

## 4 Project Management

This section will go through the different project roles we deemed important. We will explain our development method, which tools we use and give an overview of how we planned the project. Furthermore, in section X.X we also provide a structured overview of how we organized our time.

### 4.1 Project Roles

We wanted to ensure that all developers had an even workload and experience in all components of our project. To achieve this, we maintained a flat organizational structure where all decisions were made in groups, and no member would work alone on a task for a longer period of time. Some tasks and delegations, however, would be easier to assign only once to reduce time spent in transition between developers. The following paragraphs discuss the different roles we assigned.

The most central role is that of the scrum master. The role mainly consists of setting up meeting agendas and keeping control of what team-members are working on. In addition, the scrum master should act as a buffer between the team and other distractions. In our framework, the scrum master also had a casting vote whenever there was a disagreement. The group elected Haakon to be scrum master because of his well-established authority and organization.

We also assigned the role of a transcriptionist. His job consists of writing a short summary of every meeting, and making this available to the rest of the group. This includes meetings with the customer and supervisor. This job was performed by Anders, who volunteered for the position. We randomly assigned Haakon to be customer contact, and Tino as responsible for room reservations.

### 4.2 Development Method (Scrum)

Scrum focuses on having daily meetings, and constantly adjusting to changes by iterative development. This makes it easier to predict and to adjust for problems that may occur. It was hard to predict what would happen in our project, therefore our sprints were short, lasting at most two weeks. The transition between two sprints was done during a prolonged meeting on Wednesdays. During this meeting we evaluated the latest sprint and planned the upcoming one. Every team member was requested to say three good things and three bad things regarding the last sprint. This was followed by a discussion of how to plan the next sprint better. Lastly we showed what had been completed, to the other members of the group, before setting up the next sprint. Scrum also focuses on having finished versions of the systems on each iteration, and to finish all packages in the given iteration. In order to take advantage of the best in everyone's abilities we worked in pairs where this was efficient. Working in pairs is common in agile development. This was to improve code quality and reduce errors<sup>1</sup>  
[http://www.cs.pomona.edu/classes/cs121/supp/williams\\_rpgm.pdf](http://www.cs.pomona.edu/classes/cs121/supp/williams_rpgm.pdf)

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<sup>1</sup>[Page 2

### 4.3 Tools/Framework

The customer wanted our end product to be easy to maintain for future developer. Therefore we have chosen tools that are well known and easy to learn. A lot of different tools were considered for this system. Some of the most important are:

- Django, a framework written in Python.
- Editors like VIM and Eclipse were used.
- Documenting the development process was completed using google drive.
- Git was used as a version control system, with github as hosting service
- Communication were done through email lists, IRC and Facebook.
- User interface design was stylized with bootstrap and grappelli.

A full list of all tools and frameworks used can be viewed in appendix *Tools and Frameworks*.

### 4.4 Project-Level Planning

After our initial requirements elicitation we began to plan our development process. The purpose of the plan was to verify that we had enough time to complete the requirements, and to avoid unforeseen risks. This section will present the various components we introduced to structurize the project.

### 4.5 Work Breakdown Structure

WBS is a decomposition of the project into phases, deliverables and work packages. Each package was further broken down into different tasks. The benefits from doing these are as follows:

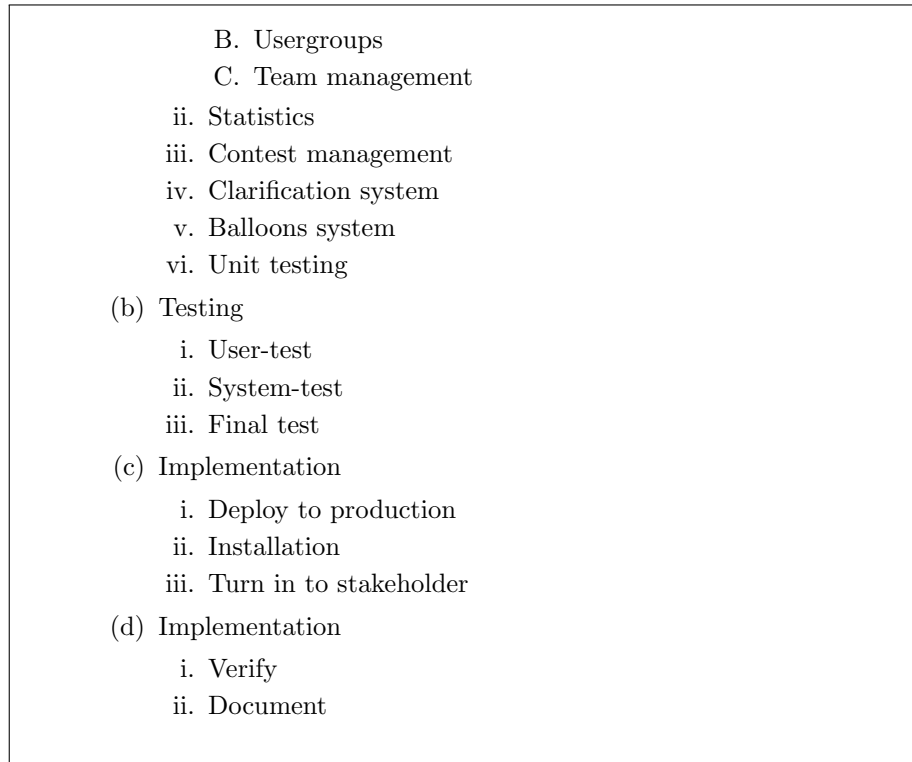
- Planning out the entire process prevents bottlenecks.
- Clearly defining the scope of a package prevents excess or insufficient time usage.
- It is easy for supervisors and other parties to evaluate and understand our process.

Table X.X shows the work breakdown structure created. These high-level packages were later broken down into activities, which are in the product backlog, see appendix

1. Project management
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- (a) Write timesheet template
  - (b) Look at the reflection notes
  - (c) Meetings
    - i. Internal
    - ii. Customer
    - iii. supervisor
  - (d) Report
    - i. Preliminary version
    - ii. Mid-semester version
    - iii. Final version
  - (e) Risk assessment
  - (f) WBS
  - (g) Status report
  - (h) Activity plans
2. Pre-study
- (a) Install and learn tools
  - (b) Learn language/framework
  - (c) Course
3. Design
- (a) Requirement Specification
    - i. Functional
    - ii. Non-functional
  - (b) System architecture
  - (c) Database modeling
  - (d) User Interface
    - i. Prototyping
    - ii. Usability Testing
  - (e) Admin interface
4. Development
- (a) Backend
    - i. Execution-node(s)
      - A. Web-page
      - A. User





We also created a gantt chart. Here, each package was assigned an estimated time period, over how long time we expected to use. For ease of comprehension, not every package was included from the WBS. The gantt chart is shown in figure 4.5

WP Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Project management															
WBS															
Pre-study															
Install and learn tools															
Learn language/framework															
Course															
<b>Design</b>															
Requirement specification															
System architecture															
Database modelling															
Tests															
User-interface															
<b>Development</b>															
Execution node															
Implement single node															
Implement several nodes															
Content Management System															
Front end															
<b>Testing</b>															
Unit testing															
Integration testing															
System test															
<b>Production</b>															
Post-implementation															

The gantt chart was revised several times during the first 4 sprints, mainly due to new deadlines set by the customer. The original chart is also given in appendix X.

## 4.6 Milestones

Throughout the project, the supervisor, customer, and the project group set deadlines. Some of the milestones marks the completion of work package(s). We have four of these milestones, M-03, M-05, M-06 and M-07. The other milestones represents events with deadlines that were given by the course stakeholders. These are M-01, M-02, M-04, M-08. The group are using the milestones in order to determine if the project is on schedule and to monitor the progress.

**Preliminary report M-01** Preliminary report is the delivery of the first version of the report. This was intended to help us get started with important aspects of the project work.

**Mid-semester report M-02** This version of the report should present all of the analysis and most of the design of our system. The delivery date for the mid-semester report is 16.03. We wanted to complete this earlier in order to focus on M-03.

**First release M-03** This milestone marks the groups first delivery to the customer. The reader can view what functional requirements this release includes in the functional requirements. In summary this release should make it possible for contestants to sign up for a competition. Three days prior to the release the group will meet up with the customer and overlook that all the requirements are met. This meeting will also act as an introduction to the system, showing the customer how to manage the system.

**Presentation M-04** The main purpose of the presentation is for the class to share their experience with other groups.

**Beta-release M-05** The beta release should contain most of the major features, but it might not yet be complete. This version of the program should only be a release to a selected group of people. From M-06 to M-07 the system will be tested.

**IDI Open test event M-06** On april the 26th we had a test event where everybody could test the system. This means that leading up to this event the system should be a release candidate.

**IDI Open M-07** This is the day of the competition and the system should be in a release version.

**Final report M-08** This milestone marks the final date for delivering the report as well as the final date of this bachelor thesis. Based on feedback received from the competition the group might choose to implement some changes to the system.

## 4.7 Meetings

Throughout this project the group have had several meetings. They can be categorized in three categories: internal, supervisor and customer meeting. We established some meetings rules:

- All meetings follow “the academic quarter”, meaning that the time of start was XX.15.
- Members that were late had to bring a cake to the next meeting.
- All members may at any time propose a coffee break. This proposal has to be followed.
- No laptop should be open during the meetings.

### 4.7.1 Internal meetings

We had three internal meetings each week. Two of which were daily scrum meetings. These were primarily set to be on mondays and thursdays. During these meetings each group member would answer three questions:

- What have you done since the last meeting?
- What are you planning to do until next meeting
- Do you have any problems regarding reaching your goal?

The group would continue to work together after these meetings.

On Wednesday we had longer meetings, marking the end of one sprint and the beginning of the next. This meeting would consist of a sprint review meeting and a sprint retrospective, where we discussed:

- What was good/bad with the last sprint
- What should we try to improve during the next sprint.

After that we held a Sprint planning meeting and created a new sprint backlog. Our official meetings structure for this meeting can be viewed in the appendix.

#### **4.7.2 Supervisor meeting**

Meetings with the supervisor was generally held at a bi weekly basis. During these meetings we talked about what we had done, what we were going to do and received feedback on what we had done. Before each meeting we had to deliver status reports and activity diagrams. These activity diagrams were early on replaced by sprint backlog and burndown charts to facilitate the process.

#### **4.7.3 Customer meeting**

Customer meetings were held whenever we felt that a certain part of the requirements specification was unclear to us, and when we wanted approval of a newly completed feature. Throughout the semester there were a lot of meetings. As we never decided upon a fixed interval between customer meetings, the frequency varied a lot. The couple of days leading up to a release date often contained customer meetings in order to get everything right before starting on the next release. During our periods of focusing on writing this report, the frequency of these meetings naturally went down as the product did not progress, and as a consequence we had little to discuss with the customer.

### **4.8 Resources**

This section contains the available resources for the project. We intended to use a minimum of 20/25 hours per person each week, but prepared for more work as we approached the deadline. This estimate was later scaled up to a minimum of 25/30 to weeks before easter, During easter, the amount of hours per week scaled up higher. Planned work Table X.X shows our first initial draft of sprints.

Sprint	Range (week)	Days	Hours
1	3 - 4	7	15
2	4 - 5	7	20
3	5 - 6	7	20
4	6 - 7	7	20
5	7 - 8	7	20
6	8 - 9	7	20
7	9 - 10	7	20
8	10 - 11	7	20
9	11 - 12	7	20
10	12 - 13	7	20
11	13 - 14	7	20
12	14 - 15	9	33
Easter	15 - 17	12	-
13	17 - 18	7	35
14	18 - 19 (Leading up to event)	9	35
After	19 - 22	21	35
Total:		91	353

#### 4.8.1 Actual work

Table X.X shows the actual sprints and work done. The hours are for each per-

son, during that sprint.

Sprint	Week	Days	Hours
1	3-4	7	15
2	4-5	7	15
3	5-6	7	20
4	6-7	7	20
5	7-8 (midterm report)	7	27
6	8-9	7	31
7	10-11	7	35
8	11-12	7	30
9	12-13	7	30
10	14-15	9	40
11	15-17 (starting 16.04, ending 26.04, easter)	10	90
12	18-19	6	35
After	19.22	21	45
Total		100	433

## 5 Design

This document contains the choices made regarding the process of designing the front-end of the application, for a more technical approach see *System Architecture chapter 6*.

### Design process

The user interface provided by the previous IDI Open system consisted of a simple web interface for reading news items, registering teams for contests, and delivering submissions. GentleIDI is intended to provide more functionality through its web interface, including but not limited to change email(requirement FC-02), supervisor(requirement FJ-11) and user management (requirements FC-01, FC-03 and FC-04). As a consequence we had two options available: reusing and extending the existing interface design, or creating our own design from scratch.

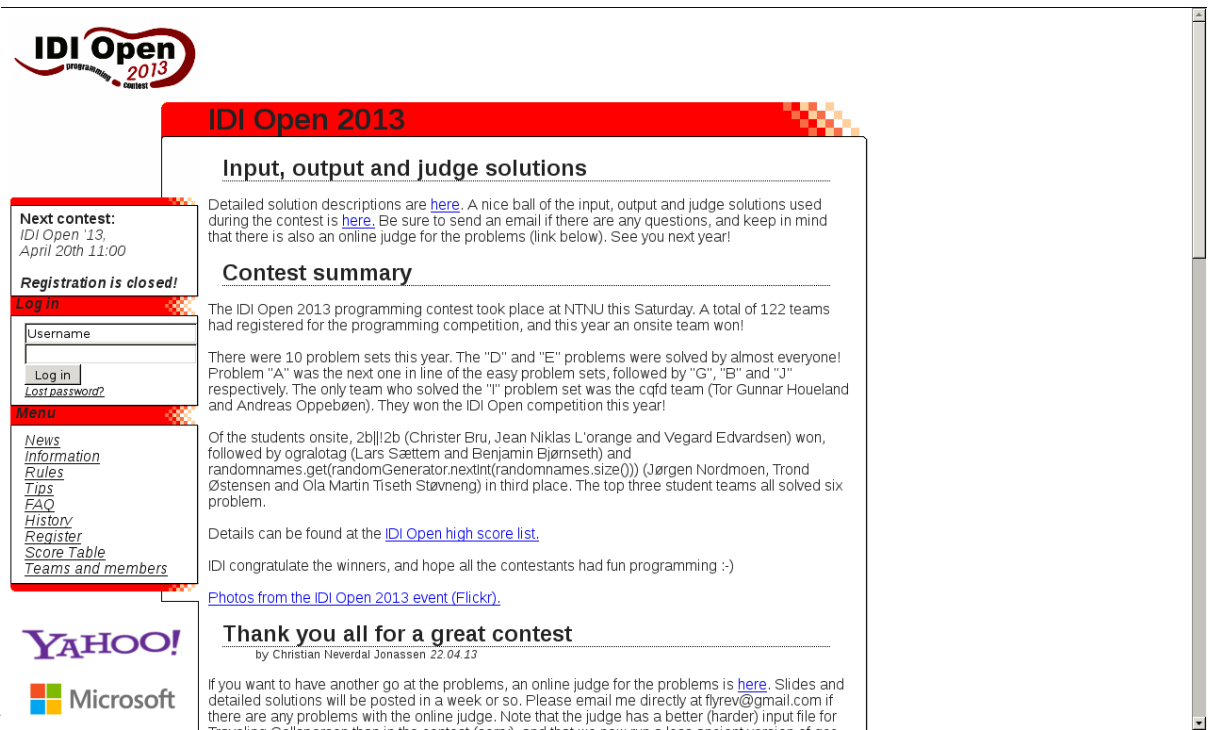


Figure 1: FIGURECAPTION

Fig 7.1 We chose to create our own design from scratch, while still trying to keep a similar placement of elements from the previous design. The customer expressed concern regarding how contestants would react to the transition from the old interface to the new one. With this in mind we started to create mockups modelling core elements of the website. Our initial drafts consisted of simple

rearrangements of elements found in the old web interface.

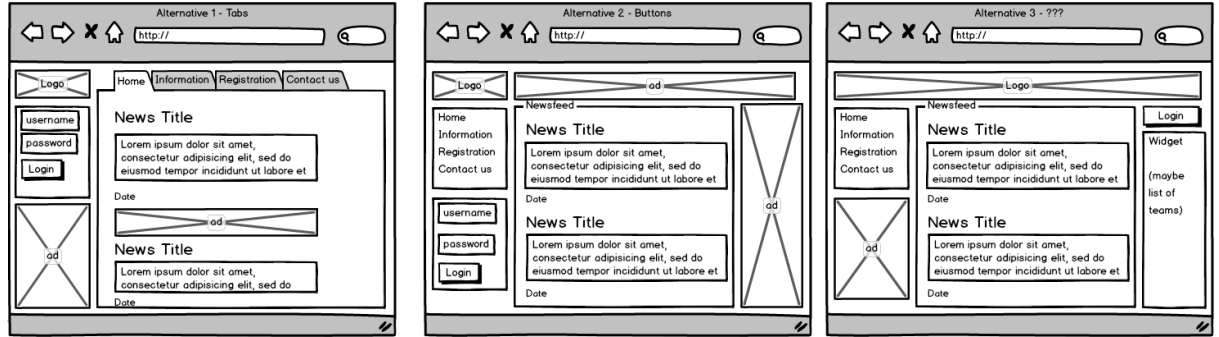


Figure 2: FIGURECAPTION

Beyond our three initial mockups we tried a couple of out of the box approaches to our designs, but none of them met our standard and was rejected for either being too time-consuming to implement or too far from what our customer wanted. We had a meeting with our customer, where we showed our mockups, and what are thoughts on design had been so far. We wanted to make sure that the customers was on the same page as us, and that we were not moving beyond the scope of the project. Our customers wasn't very focused on the design aspect, but one demand they had was that they wanted the new site to have the same structure as the old one. One example of what this means is that the customer wanted us to keep the menu on the left-side as you can see that the old system has in Fig 7.1. We agreed, because geused to a new website can take time, so keeping the structure similar would ease the transition for our users. With this in mind we decided to go for one of our initial mockups, the rightmost one in Fig 7.2, because it had the same structure as the old page, and we personally favoured that design. As a result, most of the elements found in the old interface can be found in the new one, and the transition between using the two is reduced to a minimum.

The task had to be completed in time for milestone M-03, so our main concern was designing for the functionality needed for that particular milestone. However, we also had mockups for functionality outside of this milestone. After milestone M-03 was done, we introduced new design for new functionality through continuous work on top of a template.

The majority of the front end is stylized using bootstrap[Link til kilde] as a framework, enabling us to create a site which is both highly maintainable and aesthetically pleasing at the same time. The admin interface was created using django-admin-interface with Grappelli as a skin to give it a modern look. This worked more or less automatically.

The final page looked like this:

The "black" frame was in our initial page coloured blue, but was changed one week before M-07, idiopen [ REMARK: may be altered ].This illustrates

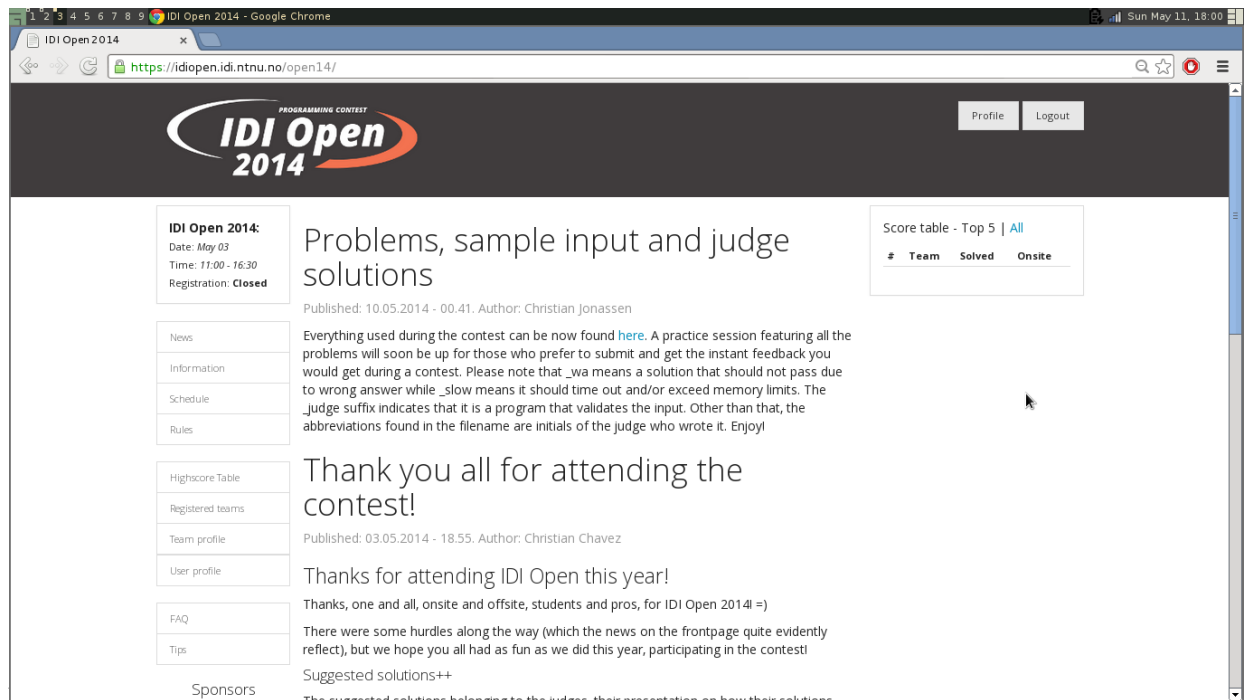


Figure 3: FIGURECAPTION

the strongest functionality of the design, namely customization. It is possible, by only uploading a new CSS file, to change the whole feel of the website and give every contest its own theme. The change on IDI OPEN 14, from blue to black, was done as a consequence of a logo change by Richard Eide, one of IDI Open's facilitators. The old color scheme can be viewed in appendix [insert which appendix]. By comparing fig 7.1 and fig 7.3, you can see that we kept the same structure, but still made some significant changes to the design.

User interface The user interface is designed by using a base template. The template is the same for every part of the webpage, and contains a content block that changes while you navigate through the different parts. This makes it easier to add new content to the user interface, because you already have the base, and don't need to worry about the header, footer or the menu. We wanted to make it easy for future developers to take over GentleIDI after us, and therefore we focused on a versatile user interface, in case they want to add new functionality.

The menu is placed to the left, coping with the western norm stating that eye placement is natural to the left<sup>2</sup>. We designed the menu to be versatile. Admins can choose what they want to show in the menu, except for *Register*

<sup>2</sup> <http://research.microsoft.com/en-us/um/people/cutrell/chi09-buscher-cutrell-morris-eyetracking-for-websalience.pdf>



*user* and *Register team* that are “hardcoded” on request from the customer. This was highly prioritized by our customers, they wanted to be able to make changes without having to change the code. As mentioned in Design process 7.1, we designed the user interface after a principle of versatility. Admins can also change the logo, the sponsor images and the contact information in the footer.

Buttons, images and icons were surrounded with boxes, for example the sponsors and the menu buttons, to show that they are different elements.. There is also one big box surrounding a group of elements, for example the sponsors. This is consistent with the gelaw of proximity, that constitutes that humans will naturally group objects that are close to each other, and view them as a distinct. This helps the user quickly understand the user interface.

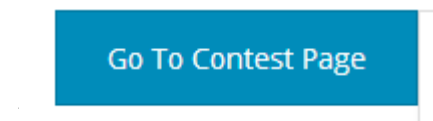


Figure 4: FIGURECAPTION

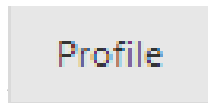


Figure 5: FIGURECAPTION

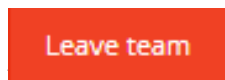


Figure 6: FIGURECAPTION

fig 7.4

“To strive for consistency” is the first of Shneiderman’s eight golden rules of interface design<sup>3</sup>, and we tried to follow this while making design decisions. As can be seen in fig 7.4, we decided to use colours that represents the action each button is connected to. The red button marks that pressing this will have permanent consequences. We added a textbox prompt that the user has to answer after pressing a red button, that constitutes to Schneiderman’s fifth and sixth rule, for easy reversal of actions and error handling. This wasn’t added initially, but we noticed while testing the system that without a prompt, it could be possible to leave your team by mistake. fig 7.5

For the contest page, fig 7.5, we wanted to give the contestant a good overview of all the problems, their submissions to them, last feedback, if they

<sup>3</sup> <https://www.cs.umd.edu/users/ben/goldenrules.html>

# Contest Page

[Clarification](#) | [Ask a question](#) | [View score table](#) | Team score: 0

## List of Problems

Click on a table row to go to the selected problem.

Hover over each title in the table to get a further explanation.

Problem ▲	Last Submission ▼	Time ▼	Feedback ▼	Solved ▼	Score ▼
Abandon Ship [PRACTICE]					

Figure 7: FIGURECAPTION

solved the problem and the score. It is important to not bury information too deep in a website. It could be challenging to balance this while trying not to overload the page with too much information. We had this in mind when designing this page. We got valuable feedback from the customer concerning what they wanted to be present on the contest page. They wanted it to be easy for the contestants to access everything they need, during the competition, through the contest page. After feedback from the customer, we added links to the clarification page and highscore table on the contest page. This lowers the short-term memory load on the contestants, which is consistent with Shneiderman's eight rule, because they will have everything accessible on the same page.

### Admin interface

The admin interface is developed as an extension of Django's admin interface. Django comes with an extensive admin interface, that provides functionality for adding, removing and changing parts of the system. The admin interface consists of everything we as developers want the admins to be able to change. For a complete listing, see figure X.X[kap 2]. We decided to use Grappelli, an app for the Django admin interface that also provided us with more adequate functionality, e.g. auto-completion, rich text editors, drag 'n drop and more.

The structure of the layout is simple. Each category has its own header and everything in blue is clickable. The "Recent Actions" box is there to help admins remember what they last did, which is important to reduce the users' short-term memory load, in accordance with Shneiderman's eight rule.

Originally all the names of the elements were the same as our model names. We decided to change this to more intuitively understandable expressions after a request from the customer. Django's admin interface couldn't give us all the functionality we wanted, so we had to extend the interface with our own custom views. We created two views, "Balloon overview" and "Judge overview". To

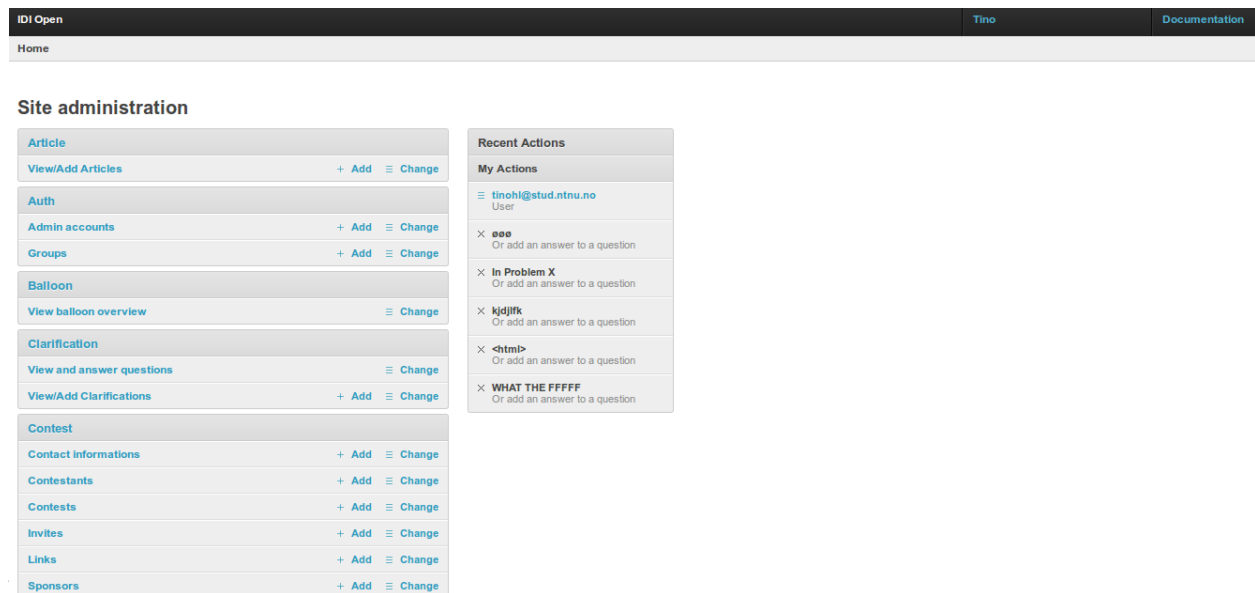


Figure 8: FIGURECAPTION

avoid having to create a similar interface as the rest of admin site, just with different functionality, we decided to extend the interface templates used for the django admin interface. This allowed us to change what we wanted, while it still kept its consistency with the other parts of the admin site.

fig 7.7

The judge overview was made primarily for judges, but could also be used by the admins. The motivation behind making this view, is that it gives the judges an easier overlook over the competition and how the progress is going for the different teams. We were initially told that the judges wanted a way to see if a team was struggling, so they could help that team.

The view consists of four different tables, with the same layout as the balloon tables. The first two tables depicts how many failed attempts an onsite or offsite team has. The Problem Overview table provides statistics on each problem for the gicontest. This was added so that the judges can see which problem has the most failed or successful attempts, and if necessary make changes. To make it easy for the judges to choose a specific team, independent of submissions, we made a dropdown menu with all the teams. The last table is the highscore list. We wanted everything to be on one page for the judges, so they wouldn't have to constantly switch between different pages.

Figure [Judge\_overview for Team]

Figure [Judge\_overview for Team] shows the judge overview after selecting the team "GentleCoding". It is possible to expand each submission by clicking on it. The third submission has been clicked on, so we can now choose to expand

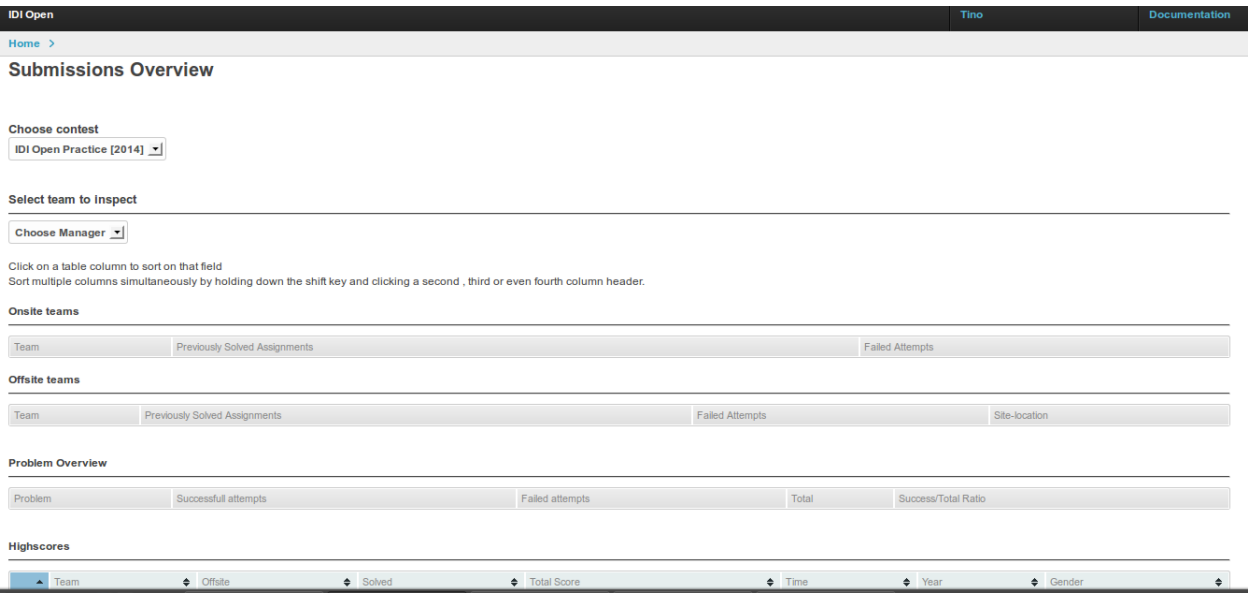


Figure 9: FIGURECAPTION

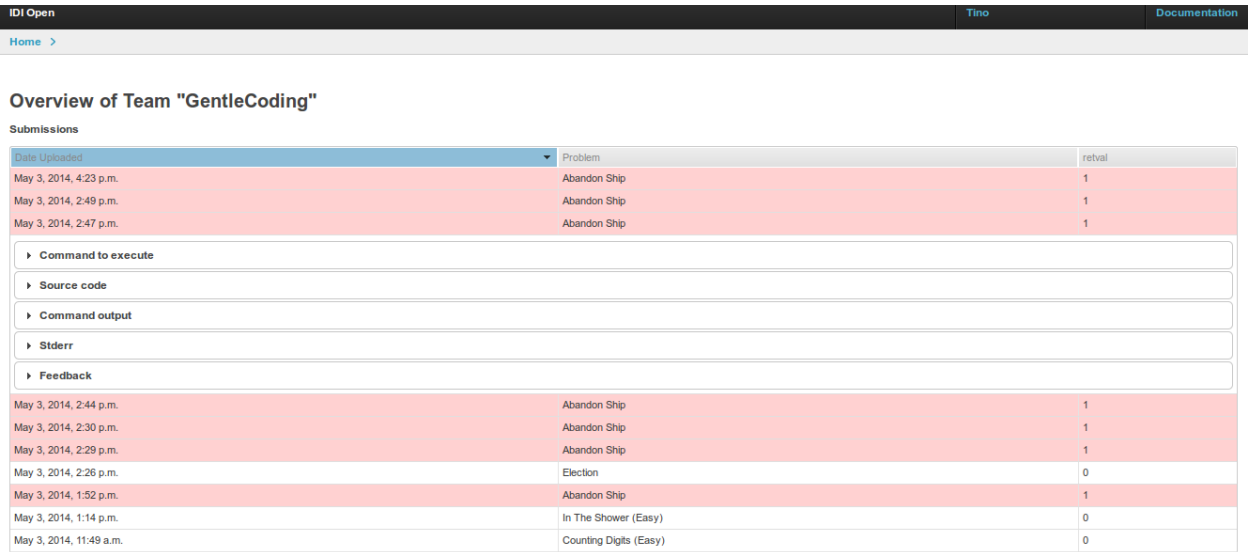


Figure 10: FIGURECAPTION

different categories. For example if a judge wants to see the source code for that submission, he/she can click on “Source code” and it will expand. Submissions that haven’t been compiled are shown in red, and the other are white.

<https://www.cs.umd.edu/users/ben/goldenrules.html>

ID	As a(n)	I want to be able to	So that
A-01	Admin	decide whether new contestpages are published or not	contests can be created when due
A-02	Admin	create a contest	contestants can register to teams
A-03	Admin	publish news	users can receive information about a contest
A-04	Admin	custom css	to differentiate different contests
A-05	Admin	custom settings for each contest	
A-06	Admin	set penalty system	contestants are given points etc
A-07	Admin	modify usergroups through an interface	maintain control
A-08	Admin	add or remove users from a usergroup	control
A-09	Admin	add or remove users from the system	control
A-010	Admin	determine what statistics are stored/collected by the system	overview and increased user experience
A-011	Admin	add/remove an execution node	scalability and safety in redundancy
A-012	Admin	configure execution nodes with compiler profiles	system flexibility and optimality
A-013	Admin	review system status	verify that contest can be hosted (correctly)
J-01	Judge	submit problem(s)	..add content to actual contest
J-02	Judge	upload cases for problem(s)	so that they can test problem submissions
J-003	Judge	upload solutions	assess case correctness to problem
J-004	Judge	verify contest problem sets and solutions	ensure that contest is O.K
CU-01	Customer	clarification system	provide communication between contestants and judges
CU-02	Customer	different usergroups	to have different roles
CU-03	Customer	user manual	ease of use
B-01	Balloon-functionary	view (correct) submissions	hand out balloons
CO-01	Contestant	register as a contestant in IDIOpen	compete in contest
CO-02	Contestant	register and administer team	compete in contest with teammates
T-01	Team	upload submission to problem	to compete
S-01	Sponsor	adspace	to advertize to users
U-01	User	receive (appropriate) error messages when errors occurs	build user-trust and nice nice
U-02	User	intuitive interface design	improved user experi-

