Q1. 12 out of 40 students attempted this modelling question and attained an overall average of 40%. Only 4 students had a reasonable understanding of what was required, but even within that group, there were some fundamental misunderstandings. The answers of the other 8 students showed little grasp of FSP, could not translate the given English requirement into modifications of the given FSP model. The poor answering clearly demonstrated superficial attention to the large collection of exercises and examples given during the course and used in lectures.

Q2. 32 out of 40 answered this question with an average score of 64% (6 < 50%, 15 >= 75%), mostly the parts were answered well, but nearly all failed to realise/remember that when checking the bisimilarity of two FSP processes via colouring respective LTSes, the LTSes must be combined/treated as one for the colouring to work (in general) --- the given algorithm is non-deterministic and could choose different colours in different LTSes when recolouring. Another failing, or common mistake, was failure to note that the FSP must be translated to an LTS. Finally, several students clearly misread the FSP in part d.

Q3. 19 out of 40 answered this questions with an average score of 57.9% (6 < 50%, 6 >= 75%). The majority of answers showed good understanding of the basic rules for FSP. However: for part (a), a number of answers failed to use the choice rule; for parts (b) and (c), application of the rules was sometimes rather confused and out of order; answers for part (d), which required the minimised LTS, sometimes had tau steps remaining.

Q4. 21 out of 40 answered this question with an average of 50% (10 < 50%, 5 >= 75%). The descriptive part of the questions on bookwork topics showed some reasonable grasp of the topics but quite often no understanding! Part b(i), requiring an FSP model of a shared counter, as a monitor, was not well answered. Common mistakes were ignoring a lock mechanism. Part b(ii), where answered, was better but some answers showed confusion between synchronised methods and explicit locking.

Q5. 37 out of 40 answered this with an average of 50% (17 < 50%, 7 >= 75%). This was a gift of a question but surprisingly not that well answered. In particular, many students failed to give the right (and obvious) answer to part (c), i.e. the parallel composition of the process COMPOSITION and property P, which then meant their answers to part (d) went somewhat awry --- although many had the right conclusion. Several students failed to read what was asked for in part (d), providing only the LTS for the final CHECK process. Several scripts indicated that the authors had no real idea about safety and liveness properties.
Ernie Hill:

Q1g) Not well answered. Most who attempted it simply mentioned that errors occur in timing when simulating and did not give the sources of these errors.

Q1h) This was well answered with most picking up the full two marks for identifying temperature and voltage as the environmental parameters that affect performance. Most also correctly stated the actual effect on performance of increasing or decreasing these values.

Q1i) Only one candidate got the definitions of verification and validation the wrong way around. All others gave very good answers.

Q1j) Most candidates got the correct answer to this question, but lost marks by not showing any calculation of the expected current drain.

Q1k) All candidates gave two reasonable reasons for not being able to continue to reduce transistor dimensions.

Q1l) This question was not particularly well answered. Most candidates who attempted it did not mentions the need to know the detailed interconnect to calculate parasitics and interconnect delay.

Q4) This was only answered by one candidate. The candidate understood controlability and observability and could describe the boundary scan method of testing. The candidate did not really understand the JTAG port and the use of the bypass register and special instructions. No diagram or adequate description was produced.

Q5) This was a very well answered question. All candidates knew the correct sequence in the design hierarchy and were able to describe them very well. The main oversight was in not mentioning how specialised software such as MATLAB could be used to develop algorithms in areas such as digital signal processing. Marks were mainly lost when discussing the tools and not mentioning mixed mode simulation or the need for low level simulation using SPICE. The candidates generally benefited from having used this design methodology in the laboratory.

Jim Garside:

First part:

1 a) Answered adequately although range of tools mentioned disappointing overall.

B) Most got this correct although one or two still failed to understand the implications.

C) Generally good; some notion that it was just for linking levels of modelling not for development/maintenance too.

D) Generally understood though no mentions of environmental factors which could cause engineered delays to vary.

E) 'What' is well understood, 'where appropriate' a bit less so.

F) Need for synchronization mentioned as a disadvantage. Advantage(s) less clearly expressed - e.g. saving in development time, allowing independent frequency optimization.

2 A question attempting to cover numerous aspects of timing and clocking.
Answer quality varied significantly.

A) Most people could answer well although the word 'debug' dominated 'design'.

B) 'Use a clock' is not adequate and regular frequencies are actually not necessary. Skew was generally mentioned. Fanout and buffering were ignored but distribution networks were recognised.

C) Surprisingly mixed answers. Really looking for difficulties in moving GHz signals around if not on chip.

D) The comprehension of the PLL mechanism was poor although there was a general idea that some such thing existed.

E) Metastability was understood. The reason it may happen was largely neglected!

F) Synchroniser flip-flops were recognised.

G) <100% reliability was recognised. The possibility of changing the probability by changing the delay (period/ number of latches) was largely neglected.

3 This question tested some wider thinking and design skills. In general the answers were surprisingly gratifying.

A) In the absence of calculators these students still managed to work out some approximate arithmetic. (This represents progress from the first year!)

b) A thoughtful range of suggestions, mostly sensible and (mostly) well judged as to requirements.

C) A difficult part. Looking for the need to keep ahead of an incoming stream which, at the same nominal rate from a different source, may be slightly faster. No one spotted the whole of this but some good reasoning nevertheless.

D) The real heart of the question. Looking for the keywords 'video' (large array which can be subdivided into several smaller 'screens') and 'stream' (suitable for pipelining). The answers largely picked up on the principles and usually managed to relate these back to the application.

E) A follow up to part d). The principles were understood; relating these back was not always highlighted though. Extra kudos for remembering about 'generate' and similar mechanisms.
This year, there were a significant number of high marks (between 70 and 100%), but also a significant number of low marks, resulting in an average of 56%.

The students were supposed to choose 3 out of the 5 questions in the exam, each worth 20 marks.

Questions 1, 2 and 4 were the most popular questions, probably because the topics covered within these questions were also covered in the coursework for this unit, where the students had the chance to implement solutions to various practical problems related to these topics.

As in previous years, bookwork and application questions were well answered by most students. However, the students struggled more to answer well the original thought questions.

Question 1:
This question covered the technology choices for relational and object-relational databases, and it was the most popular question in the exam. In general, the students who solved this question scored highly, with a few exceptions.

Question 2:
This question covered the topics related database functionalities implemented on server side. This question was divided into two parts: a bookwork part and an original thought part. Most students scored highly for the bookwork part, but fewer students scored highly for the original thought part.

Question 3:
This question covered the topics related to object database applications. It was not a very popular question, but most students who solved it, answered it quite well.

Question 4:
This question covered the topic of semi-structured data management and it was a very popular question. Most students did very well for most of this question, doing less well when mapping the semi-structured schema into a structured one.

Question 5:
This question was the least popular one, covering the topic of distributed databases. It was the last topic delivered in the course, and was not at all covered in the coursework, so the students did not have a chance to try it in practice. Although the question was not a hard one, covering bookwork and application aspects of the topic, very few students tried it, but the ones who did, did very well.
This question was very popular, with all but a handful of candidates attempting it.

A) Most candidates scored a perfect mark for this part of the question. The most common cause of lost marks was in misreading the database symbol as a software component, instead of a purely data component, and therefore saying that M4P was semi-decomposable and DeLink’s system decomposable. A very small number of people also read the stick people user symbols as being software interface components, which also led to them giving the wrong answer.

B) There were several strong answers to this question. Where marks were lost, it was generally due to a lack of specificity in the answers. For example, some candidates talked about the general pros and cons of forward/reverse migration (“In rev. mig. The new data structures don’t appear until late in the migration”) without tying them to the specific features of the scenario (“the new data structures are needed to support the most urgent functionality”). Some answers were also very brief, and so earned few marks.

There was some disagreement between candidates as to whether the functionality to produce the government reports required the new data or not. This was a little ambiguous in the question text, so I accepted both positions as correct, and marked accordingly.

Another, less common, source of lost marks was the various misunderstandings about the strategies themselves. Some candidates appeared to believe that the various strategies consisted only of their first steps: that is, in forward migration we only migrate the database, and the functionality is never migrated, while in reverse migration we only migrate the functionality and not the data. This is not correct. The same migrations are made in each case, only the order of the migrations matters.

The answers relating the general migration were the poorest. A significant number of people still referred to general migration as being a hybrid of forward and reverse, with the migrations occurring from the top and the bottom simultaneously. As discussed in lectures and at the revision session (and in much of the exam feedback for this question in previous years) this is not correct. Other misconceptions about general migration involved claims that it requires a lot of downtime (presumably meaning downtime for the database migration, but details were not specified in answers), plus claims that some aspects of the functionality would never be migrated with general migration.

C) While most people managed to get some marks for this part of the question, there were very few really strong answers. This year, more people attempted to describe their migration steps in words, meaning that answers were more complete. But, unfortunately, many of the answers were highly ambiguous. E.g. “add in forward gateway to connect between the target database and the legacy components”. Phrases like this mean I have no idea of exactly which components are connected to which, and therefore cannot award full marks.

There were a number of commonly occurring errors, related to gateway placement and migration strategy:

+ A number of candidates added in gateways from a target component to a target component. Gateways are only needed to allow legacy components to talk to target components and vice versa.

+ A number of candidates correctly placed forward gateways after the database migration step, except that they connected the gateway to the DeLink Query Layer, instead of directly to the Advice Line Mgr component. The Query Layer is a data access layer component, and as such its features are covered by
the new RDBMS data access layer component. It is not needed after the first forward migration step.

+ A number of answers failed to respect the layering constraints when adding new components in. For example, after introducing the Activity Log Services component, some candidates used a forward gateway to connect this to the legacy components such as the M4P HelpLine Manager component. These are both application logic components, and so implement business rules. There is no point in executing them both, and there may even be harm in doing so, since the newer component is likely to implement a newer set of business rules than the older one, and the business rules may conflict. If the legacy components had been more decomposed, we could have connected them in and used the old GUIs on top of the new application level functionality. But, because they are decomposed, we have to wait until we have a complete functionality stack from GUI to database before these new components can be evaluated in real use.

+ A small number of candidates linked forward gateways directly to the raw databases, and then in a second migration step installed the data access layer and created yet more gateways to communicate with it and the legacy components. Writing gateways to connect to the raw data is a waste of time and effort.

Finally, very few people gave a clear business case for their decisions, beyond pointing out that the government reports were high priority and so should be done first. A few people merely stated a position (“Legal is more important than Outreach”) without justifying it in some way. I am happy to accept such statements and mark as if they were what I had in mind, but some business justification needs to be given as well.

Andy Carpenter:

Question 1
a) i) Most answers did not explicitly identify the lack of domain knowledge as the biggest concern. They also had weak justifications. Many answers identified why each aspect of the colleagues lack of knowledge was a problem, rather than identifying the biggest concern, as asked by the question.
ii) Many answers had a weak justification. Also most answers failed to relate their suggested approach to the reason the code was being read, e.g. familiarisation, and why it was an appropriate approach for this.
b) Many answers did not give a language independent representation. They also failed to identify the elements of the idiom in the code given. Finally, several answers failed to note that more than one idiom was present.
c) Several answers failed to label the TRUE and FALSE arcs from condition nodes

Question 3
a) This part was generally well answered. However, most students failed to recognise that in part iii) the two interpretations of the date where in different countries. Thus, the difference was probably cause by portability issues.
b) Marks were lost by not giving sufficient detail. For example, the volume of data that would need to be moved to the WHU database and the effect of this on push or pull choices. Also, when using incremental updates what logs need to be examined at the times of the different feeds.
May Exam:

ACS:
The following only concerns Questions 1 and 2 of this exam.

It should be pointed out that the exam mark is not the final mark for this course unit. The final
mark is calculated by applying a factor of .4 to the exam mark (taken out of 100), multiplying
each of the coursework marks with .3, and adding the three together. General remarks: 35
students answered questions from this part.

Question 1. I was very disappointed with the very low quality of many of the answers for this
question. It was marked out of 20, and of the 35 students attempting it 15 received a mark of
7 or lower (that is a failing grade) and only 2 managed a first class mark. The average mark
was 8. Students who had marks of five or lower wrote down very little that was both relevant
and true.

A) To find pure strategy equilibrium points all one has to do is check whether one player can
improve their pay-off by changing their strategy while the other players stick to theirs. There
are only two strategies per player. An example for doing this is given in the solution to
Exercise 14 (although unfortunately the exercise itself somehow got cut from the notes by
mis-take). It is possible to find one equilibrium point by using dominance arguments, but that
doesn't give the other, so students who did that lost a mark.

There are two pure strategy equilibrium points in the game, and two marks were awarded for
finding those, which the majority of students could do. I then expected a discussion on what
would happen if there was actual play, but almost nobody got the two marks for noting the
following:

- Player 2 prefers one of the equilibrium points (which gives a pay-off of 1 over 0), Player 3
prefers the other for much the same reasons.

- Player 1 gets to choose which equilibrium point they arrive at, but he gets a pay-off of -1 in
either case. He would like to move away from them but there's nothing he can do about it! By
sticking to their preferred equilibrium point strategies Players 2 and 3 would in each round
receive 0 or 1, so over time they should accumulate winnings. Player 1 would be best off by
refusing the play.

B) This was really a version of the Prisoner's Dilemma game discussed on pages 35f of the
notes) with a different story and different numbers. The majority of students could carry out
the removal of dominant strategies and they arrived at a (1 x 1)-matrix, gaining 3 marks for
doing so. In the second part, for two further marks, students were expected to note that they
had found the only pure-strategy equilibrium point, that both parties would be better off by
choosing their alternative strategy, but that then there would be the temptation of changing
one's mind again due to the possibility of getting an even better pay-off. Almost nobody wrote
down all three facts.

C) If we assume that there are two pure strategy equilibrium points say (I, j) and (I', j') then it
must be the case that either i=I' or j=j', so at least one player has two strategies that lead to
an equilibrium point. (Many assumed that I, I', j and j' were all automatically distinct, which
is not true.) We know from that any mixed combination of equilibrium point strategies for one
player paired with any mixed combination of such strategies for the other player gives another
equilibrium point, and there are infinitely many of these. Many students at least noted that
every pure strategy is a mixed one, so there are at least two mixed strategy ones, but few
people got all the marks for this question.

D) Proposition 1.14 tells us what needs to be done, and this is illustrated in detail on pages
47f of the notes, which says that a pair of mixed strategies gives an equilibrium point
provided that neither player can improve their pay-off by changing to one of their pure
strategies. Many students seemed to want to describe the process but did not manage to do
so without mistakes.

E) A number of students did not seem to read the instructions in detail, they talked about under which circumstances it is feasible to describe a game in either form. The question that was asked, however, was what would be a preferable description when the task is to find a good strategy under which circumstances. A game in normal form makes it much easier to find pure strategy equilibrium points. If the game in question is 2-person zero-sum then there is an algorithm for finding mixed strategy equilibrium points for games in normal form. If, on the other hand, it is important to model the decisions made in the course of playing the game, or one wanted to implement the search for a strategy by learning then a game in extensive form would be preferable. There were many wrong statements among the answers given to this question.

Question 2. This question was attempted by 34 students. The average mark was 10 out of 10. Six students got a failing mark and eight managed a first class answer.

A) Almost all students picked a 2-person zero-sum game of perfect information without chance and managed to classify it as such, getting both marks.

B) This was one of the worst answered parts of the exam. In game-theoretic terms a solution to a game is an equilibrium point. I expected students to point out that for games mentioned in a) it is the case that either one of the players has a winning strategy or they can both ensure at least a draw (Theorem 1.10 in the notes). A number of students said that a winning/drawing strategy would be a solution but failed to assert that this is guaranteed to exist. The two students who chose such games with chance would have had to remember Proposition 2.12. There were many answers here that completely ignored game theory and did not define solution in a sensible way.

C) Most students talked about a program as described in Chapter 4 of the notes. For these I awarded a maximum of 4 marks each for the top-ics of move generation and board representation, evaluation function and alpha-beta search, and there were two additional marks for general points. Students who presented alternative approaches were marked on the quality of their description. Most students got a decent percentage of the marks available, but there were many very confused and quite a few out-right wrong statements. Students seemed particularly confused about the notion of strategy (doesn't really apply here), 'quality of moves' (the program doesn't try to classify the moves as such, it classifies the positions moves may ultimately lead to), at which point the evaluation function (or heuristics) is employed and how, and what that means for the alpha-beta algorithm. Also, the part of the answer referring to the particular game chosen often was rather weak.

XJZ: General Feedback to Question 3:
• 34 students (i.e., almost all students) answered this question;
• The average mark for this part is 65% (i.e., 13 marks out of 20);
• Only 2 or 5% students received a mark of less than 40% (i.e., 7 marks or fewer), in which one student got 1 mark and the other got 3 marks. Both students seem having done very little to prepare for the exam;
• 16 or 47% students received a mark of 70% or better (i.e., 14 marks or more).
• General speaking, the students' performance in this question is satisfactory from the teaching outcome point of view. One possible reason for this is that the students have done a project close to the exam question and so they are familiar with the topic and well prepared for the exam.

Detailed Feedback:
• Question a). A few students gave the complete and accurate answer to this question but most students answered this question incomplete or inaccurate. The main issues include a) the rule of Stackelberg game is not given; b) the definition of Stackelberg strategy is inaccurate. For example, some answers said that Stackelberg strategy is the one which maximises the payoffs. This is inaccurate because this is the feature of all solution concepts in game theory but it is the particular way to maximise their payoffs that leads to the different solution concepts. So the issue here is that the students knew the concept but did not present their answers accurately.
• Question b). Except to a couple of students, most students answer this question well and more than half students got the full mark in this question. Common mistakes in answering this
question are: a) the second order condition has not been checked; b) some simple computing mistakes.

• Question c).
OMost students answered question C.1) correctly;
OHalf students answer C.2) (the multi-choice question) correctly;
OQuestion C.3) is to justify the answer to the above multi-choice question. Most students only answered this question partially. To answer this question completely and correctly, you need to, firstly, identify that there are three possible choices for Player 1: 1) play Nash game; 2) play Stackelberg game as a leader; 3) play Stackelberg game as a follower; secondly, give an example for each choice that Player 1 will not always better off. Most students only gave the example to Choice 2 and showed that Player 1 is not always better off if he plays Stackelberg game as the leader. Several student discussed Choice 1 and explained that Player 1 is not always better off if he plays Nash game. However, few students gave an example or an explanation to show that Player 1 is not always better off if he plays Stackelberg game as the follower.

General Feedback to Question 4:
• Only 4 students answered this question. The possible reasons are that, firstly, no coursework is related to this question and so the students are less familiar with this part of teaching. This may be the main reason; secondly, it requires more insight into the topic in order to answer this question than just remember the materials in the lecture notes.
• The average mark for this part was 46% (i.e., 9.25 marks out of twenty). The highest mark is 11 and the lowest is 8. Two students took both Questions 3 and 4.

Detailed Feedback:
• Question a). This question includes two sub-questions:
oThe first one is that there are two participants. 3 students gave the correct answer to this question but the argument that it is the correct answer is weak or missed
oThe second one is that there are three participants and all students answered this question correctly.
• Question b). All students only answered this question partially. The mistakes included
oThe size of the population is far too small than needed. As there are 100 participants, your population needs at least 100 and better much more in order to allow to eliminate the weak players or losers from the population;
oThe bid values were not specified. As it is stated in the question that W=50 and only all bids between 1 to 50 should be chosen;
oThe search operators or the structure of the algorithm were not defined
• Question c). Again all students only answered this question partially. The mistakes included
oNo student explicitly recognizing this as a multi-armed bandit problem;
oThe update equation was missed;
oThe answer to the optimality was incorrect or missed
1.1a Answered well overall. One or two answers failed to actually describe the process, i.e. pick three cards, decide which is the "odd one out".

1.1b In the main, the hierarchies provided were good. In a number of answers, where concepts were identified as definable, definitions weren't given, or if they were, the definitions were not particularly well stated. In few cases were the relations used in the definitions stated (as asked for in the question).

1.2 Reasonable answers overall. Ideally answers should have made reference to the relationship types discussed in the course (component-integral, member-bunch etc). The "solution" expected was to introduce hierarchies of partonomic relationships, with transitivity only asserted where appropriate.

1.3a Bookwork.

1.3b Bookwork.

1.3c Mixed answers to this question. Some simply referred to "a reasoner" without outlining particular reasoning services, e.g. subsumption checking, consistency checking etc. Most answers had a fair discussion of the use of reasoning to support engineering, for example, building subsumption hierarchies, sanity checking definitions, and so on.

1.3d Answered poorly overall, with many answers failing define an extra-logical service as one not directly about the underlying semantics/logic of the representation language, e.g annotation or labelling. Fact++ and Pellet are not extra-logical services! Where a service was identified, in the main its usage was also justified.

1.3e Number of answers failed to describe OWA correctly.

1.4 Mixed answers. Most answers agreed with the statement, although any position was acceptable, providing it was backed by reasonable arguments. Few made explicit reference to the roles of a KR as asked for in the question. However, just stating the roles is not enough!

2.1a If the question wasn't answered at all then 0 points. ex: "KR being surrogate induces it being an expression of ontological commitment also," merely restates the question.

1 point was given for a coherent answer that at least explicated one of the roles.

2 points if the answer explicates both roles but doesn't answer the question. To get all 4 points you needed to articulate how surrogacy requires abstraction which requires choice.

A surrogate is most definitely not the thing itself!

2.1b A common problem was not getting the SCA/WCA distinction. Some people missed the "cognitive" part (e.g., said that a SCA KR directly modeled the domain). Others missed the strong/weak distinction (remember weak == usability, not "inadequate").

2.2a High cognitive complexity, itself, is a negative, not a positive. Increasing computation complexity, all other things being equal, increases cognitive complexity by "making the system slower". If the way you increase computational complexity is by increasing expressivity, that increased expressivity might "raise" OR "lower" the cog complexity.

2.2b No where in the text is rover said to be a dog; nor is it "implied" to be! This costs a point.
What *is* said is that Fluffy is *NOT* Rover, but that might be because rover is a tree! Dog is not stated to be a subclass of animal (nor is it implied).

2.3a
Note that elaboration tolerance does not imply that additions will not make the ontology inconsistent: Indeed, there may be elaborations which SHOULD make the ontology inconsistent (e.g., I say that the egg is both cracked and whole).

2.3b
The use of concrete in the egg was an excellent outlier elaboration. "What happens if the egg is cracked too slowly" is actually a good elaboration to tolerate and the rational "Everyone knows it won't work" is "why" it should be tolerated.

2.4b
A key often missing bit is that we have weaker performance constraints at development time. I was generally forgiving of this.
Section A - ENL

(Questions 1 and 2)

General comments and statistics

1. 38 students out of 39 presented the exam 1st June, 2011.

2. Section A was marked with a maximum of 25 marks.

3. The average mark of section A has been 13.94/25 which represents a 55.8% of performance.

4. Applying the theory of complex networks, there are two clear clusters of students: the ones who have got very good marks, and the ones who have got pretty bad marks, without very few students in the middle. For me, this is a clear evidence of how the attendance to the classroom has influenced students to get higher marks. In my lectures, approximately only 20 students were attending the class every day. The rest did never appear or appeared very occasionally. This fact is reflected clearly in the results:

   a) Number of students with 25/25 (100%): 4 students (10.5% of 38)
   b) Number of students with a mark between 19 and 25/25 (76%-100%), including the ones with 25/25: 11 students (28.9% of 38).
   C) Number of students with a mark between 18 and 12.5/25 (72%-50%): 11 students (28.9% of 38).
   D) Number of students with a mark between 12 and 0/25 (48%-0%): 16 students (42.1% of 38). It coincides approximately with the number of students who have not attended regularly the lectures.
   E) Number of students with less than 5/25 marks (20%): 3 students (7.9% of 38).
   F) No student had 0/25. The lowest mark was 2/25.

5. Only 2 students out of 38 answered question number 2. One had the maximum mark of 25/25, the other had 12.5/25. The average mark for this question is 18.75/25, representing a 75%. It is clear why most of the students answered the first question. Question 1 was about complex network models and topological properties. It was the first part of the course, and there was a special emphasis in the classroom, the course material, in addition, the first poster session was about this topic.

6. 36 students out of 38 answered question 1.

Specific comments

My comments are focused on question 1, because almost the 95% of students answered this question.

1) Focusing on the group of students whose mark was between 12 and 0 out of 25, and taking into account the rest of exams, there was a misunderstanding about the complexity of regular networks. We highlighted that regular networks are not a class of complex networks. Nevertheless, we needed to study them, since several models of complex networks use them as a starting point.

2) Many students had problems to understand the main topological properties of complex networks. I gave a lot of clues in the question itself: size (average path length), density (clustering coefficient) and connectivity (degree distribution). Most of the posters of the first part were about the computation of these properties. This is probably an indicator that some students did not participate in the creation of these posters. This is something that we all have to reflect on.

3) I have also detected that many students have difficulties to structure and write ideas. Many
students write in a slide-style, but they have problems to write an essay. We should also reflect on this fact. I do not think this is a good thing for 3rd year students.

4) For the next year, we should rethink the structure of the exam.

Final comment

It has been really a pleasure to teach you this exciting topic. I have learnt a lot from you and I have enjoyed a lot the lectures. I hope that you can use this in the future. Good luck!

Section B - PM

In general I am pleased that a large majority of exams obtained results above 50%. There were a couple of excellent exams (on both answers) and several very good ones. The content of most of the lower score answers suggests a rather compelling view that these were from people who did not attend class (e.g. diagrams similar to those on the handouts were produced but the associated description was totally wrong).

The most common error (in question 4) was a disturbing trend of answers that confused genetic programming with genetic algorithms; also there was a confusion between evolutionary algorithms (the general term for all of these) with evolution strategies or evolutionary programming (which are two specific algorithms). In question 3, some did not understand that the algorithm requested in part c) was only for one dimensional line searches.

Overall a large majority of students chose question 4 instead of question 3 (approx 1/3 versus 2/3). I am satisfied with the scores, although I would like to see them go up next year and these results will help me improve next year lectures.

Section C - MDM

The results in the third part of the exam were not very impressive. There were approximately 10 students who did a good job, and the rest of the results were quite poor. Most of the problems relate to Q5, all those who attempted Q6 did quite well. The main problems were linked to FP representation of a real number and the construction of a graph for a simple arithmetic operation and estimating the absolute error from it. The latter task was given as a homework in lectures, but not students attempted to do it. Q6 was closely linked (and even simpler) than the coursework. I believe that the number of students who attended the lectures and who did a good job with their coursework is closely linked to the number of good marks in the exam (although I can't garantee one-to-one correspondence). But the trend is quite indicative.
Q1. About 30% of the students answered this question. No major problems except in part (c), where most students failed to notice that this transformation could be used to break dependences (hence enable parallelism).

Q2. Almost everybody answered this question. No particular problems except that a surprisingly high number of students failed to produce a DFA in (b), but produced an NFA instead (without realizing that what they showed as an NFA didn't meet the requirements of a DFA).

Q3. Answered by more than 80% of the students. No major problems, except that in (b)(ii) many students didn't take into account all the valid combinations for 2 or 3 lookahead symbols.

Q4. Not a popular question. Answered well by the few students who attempted it.

Q5. A popular question. There were several inconsistencies with the interference graph in (a)(ii) (it is ok if it is assumed that the end of a live range doesn't interfere with the start of another, but no matter what one assumes, this should be applied consistently for the whole basic block). In (b) many students failed to realize that the approach to find live ranges was based on LIVEIN LIVEOUT. In (c)(ii) many students seemed to talk about different ways to calculate priorities and not about breaking ties when several operations have the same priority.
Carole Twining:

Q1)

Overall, tendency to miss-out details of possible problems that might be encountered when applying the various algorithms.

As an open-ended question, this prompted some very imaginative answers, and some of these lost out due to insufficient detail. Many people mentioned thresholding, but few went all the way and told me how to find the best threshold by drawing an image histogram. A common mistake was failing to address what gaps might appear in the thresholded image, and what you could do to try and improve this. There was also some confusion as to whether 0 or 1 meant dark or light, and which way round the threshold was.

Some suggestions were made to use edge-detection, but few spotted that edge detection on these structures would give PAIRS of edges, and junctions couldn’t be simply found from thresholded edge images, unlike the case of finding junctions from skeletonized thresholded images.

When it came to skeletonization. Most remembered neighbour counting to find junctions, but again very few answers pointed out possible problems with the skeleton.

When it came to pixel-counting to measure lengths, not everyone remembered to include extra factor for diagonal neighbours.

There was a wide range of ‘alternative’ answers given to this question, which gained marks provided the explanation was full enough, from edge-detection with hysteresis, to using Active contour models.

But overall, most people that attempted this question came up with some sort of answer, however imaginative, and gained marks as long as they had some decent reason as to why they might expect their method to work at all.

This is in contrast to question 2, where if you didn't know the relevant book-work, you couldn't gain much from trying to make what you did know fit the question!

Q2)

Some people got confused as to whether they should be referring to shapes or images. Also some confusion between ASM/SSM/AAM.

Not everyone noticed for part a) that the landmarks had been provided, although the wording was possibly slightly ambiguous as regards this. Most people remembered alignment and some sort of PCA idea. A common mistake was not being specific enough as to what degrees of freedom were being eliminated using alignment/class of transformations being optimised over, or pointing out that the alignment was an iterative process.

For part b), there was some confusion between landmarks and additional shape points, hence some people thought that the additional shape points (equally spaced between anatomical landmarks) were the equally-spaced points being referred to, rather than non-anatomical and equally-spaced landmarks. Very few answers actually mentioned correspondence and spurious degrees of freedom.

For part c), a very common mistake was telling me about USING an ASM in search, rather than BUILDING one. Some people also got confused and told me about ACMs instead.

Part d), most people got the result right, and gave some sort of explanation. Very few though mentioned specific knowledge of shape versus NO specific knowledge of shape.
Q3.

Overall, people that knew the relevant book-work seem to be able to answer this question fairly well. Many people were also able to answer question 3c which showed that they had a good understanding of the material.

Couple of common mistakes made when answering this question:
- When describing the mean shift algorithm, some people confused the difference between finding the mean value (average value) within window W and finding its centre of gravity. At each step, the Mean shift algorithm needs to find the centre of gravity within the search window W and then shift the window towards this new centre. This means that at each step, the search window W moves towards denser regions in the feature space.
  - Some people confused mean-shift clustering with mean (and median) filtering in image processing and described the procedure for image smoothing.

Q4.

Overall, people answered this question well with some of them exceptionally well. Couple of common mistakes:
- Many people did not explain how to match interest points in both images in order to find corresponding points.
- Some people chose edges instead of corners as places to find interest points.
1. General comments

The following statistics refer to unconfirmed marks. Overall performance was down, compared to the previous year, the average mark being ~53.4%, however numbers taking the examination had risen from 18 to 54. The highest mark awarded was ~81%, the lowest ~16%. Question 1 averaged 64.45% (50 candidates answered), Question 2 ~51.8% (45), Question 3 ~47.1% (37), Question 4 47.2% (18, including one candidate who obtained 0 marks) and Question 5 ~51.8% (11, including one candidate who obtained 0 marks). Two candidates answered parts from >3 questions, only parts from 3 questions were marked. One candidate’s handwriting was so poor that numerous words were illegible despite best interpretative efforts, thus marks inevitably could not be awarded. It was noticeable that numerous candidates apparently relied on own experience of information retrieval (and almost exclusively on the web search aspect of IR) in attempting to answer questions. While personal experience is essential for experiential learning and is to be welcomed in informing an answer, it is not a substitute for academic, technical knowledge. It is possible that there is a strong correlation between relying on own experience and non-attendance, however this remains a suspicion. There is more direct evidence for lack of engagement with course material and the wealth of literature in the field.

Candidates clearly preferred to address questions with a larger proportion of parts requiring factual answers rather than question 5, a single part question calling for discussion, criticism, argumentation and evaluation (although all questions contained at least one part of such nature). This is disappointing given employers, as well as examiners, might reasonably expect potential graduates to display such abilities. Several candidates failed to appreciate the need to match content of answer to the associated available mark, setting out much often irrelevant or superfluous detail for parts that carried few marks, and little detail for more highly-valued parts. Where part answers were underdeveloped, causes could reasonably be traced to, variously: not addressing all aspects of the question, not being able to structure an argument, reliance on own experience rather on knowledge acquired through study, and in particular to vague, general statements with no real technical content, leaving the marker with nothing much to credit.

2. Question-specific detail

Question 1

1a) proved a good distinguisher, in that several students revealed unfamiliarity with technical concepts concerning information needs, ‘navigational’ being incorrectly related to establishing a route to a geographic location and ‘transactional’ being exclusively related to financial transactions. Several students revealed further lack of knowledge of the notion of task, relating it incorrectly to the task of finding information. There was much unquestioning acceptance of the notion that a query should be assigned to a single class of need, betraying a lack of consideration of what can happen in going from task to need to query. Several answers commented sensibly on complex needs.

1b) was another good distinguisher. Several answers were characterized by poor attention to detail and by failing to make assumptions clear. For example, an index term might be given as ‘Rock’ and would be matched with a query containing ‘rock’ with no explanation regarding case folding; tokenization involving removal of apostrophe would be said to take place, and an index term recorded as ‘east’ with no explanation of what had happened to the possessive ‘s’ in the original string. This question required strict attention to the implications of various decisions on tokenization, case folding, stemming, etc. Some candidates did a good job on the indexing aspect but failed to mention how they mapped query terms to index terms (or why such a mapping attempt would fail, for the given user query). At least one candidate showed no knowledge of binary term-document incidence matrix and inverted index. Some candidates ignored the instruction “assuming no change by the user to the query” – which does not preclude a change by the system once it receives the query as input (stemming, case folding, etc.).

1c) answers showed general knowledge of the concept of skip lists, however practical application/calculation escaped several candidates. Some apparently forgot that a final
comparison of 47 with 47 was also necessary to establish a match. Practice based on reading the relevant section in the course text book would have helped.

1d) answers showed some good knowledge and introduction of own reading results, however several of the answers were quite underdeveloped.

Question 2

2a) was a good distinguisher, revealing those who had engaged with the literature on stemming and followed up pointers to resources on the course web site. Some candidates appeared to have an English-language-centric view of the world, thus ignoring the fact that stemming as a technique may be more suited to other languages, depending on their linguistic make-up.

2b) was relatively well answered, although several candidates confused transliteration with translation, and the apparently more technical concept (requiring actual knowledge of the field) of asymmetric expansion was not on the whole tackled well.

2c) occasioned several answers giving a formula rather than a result/value, probably thus indicating memorizing of the formula but not the ability to apply it. A little logical thinking and some primary school mathematics would have revealed a rather obvious answer.

2d) was mainly well answered, although some answers failed to connect the two parts of the Manning et al. quotation and/or failed to say how we can use the notions mentioned to rank documents.

2e) revealed in some answers a basic misunderstanding of the nature of IDF in relation to a single term query.

2f) was well answered by most although some candidates had clearly not understood the significance of a high or low cosine score. An answer on the L2 norm along the lines “because it normalizes the input” does not convince an examiner that a candidate actually knows anything about the issue. This is akin to answering the question “what does a graphic equalizer do?” by saying that it equalizes the graphics.

2g) answers were in several cases underdeveloped, so throwing away marks. Some candidates chose to ignore decades of research into IR (read the question) and instead discussed the statistical analysis of web logs.

Question 3

3a) was answered well on the whole, as was 3b.

3c) was a good distinguisher, several candidates failing to understand the relationship between the plots for the two systems and the (stated) requirements of a systematic review. Such an example had not been seen in lectures, thus called for understanding of key concepts of precision and recall and the application of such knowledge to a real problem faced by those asked to undertake a review of some topic.

3d) was also a relatively good distinguisher, several answers showing basic misunderstandings.

3e) was poorly answered by many. The key notion of how n-grams are constructed apparently escaped many (e.g., for n=2 (bigrams), take consecutive pairs of tokens, in one token increments).

3f) was another good distinguisher, requiring problem analysis and application of knowledge, further requiring an ability to abstract away from the modern digital world to an older world where concepts and techniques of information retrieval were nevertheless present.

3g) offered some good answers, however there were also several that were very underdeveloped.

Question 4
4a) distinguished those who had a clear idea of the concepts behind the RDF data modeling language from those who did not. Some answers gave loose representations, not indicating clearly what was a value as opposed to a resource.

4b) answers were left quite underdeveloped by several candidates, containing vague generalities.

4c) saw some good answers. Some candidates did not address both external and internal issues. Several answers brought in material not introduced in lectures (e.g. microformats).

4d) was well answered, although again there were some underdeveloped answers.

4e) answers can be characterized by the same comment. Underdeveloped answers appeared to betray a lack of reading around.

Question 5 was answered well by all candidates except 3, who obtained <=4 marks. Answers showed on the whole good evidence of deep learning, reference to examples not mentioned in the lectures, and good evidence of ability to structure an answer, to develop it and to reach motivated conclusions, backed up by solid evidence drawn from own reading.

3. Conclusion

The overwhelming impression gained, especially on the basis of underdeveloped answers, is that there is a definite lack of engagement with the literature, with resources pointed to from the course web site, leading to an inability on many occasions to develop an answer towards achieving full marks, presumably due to lack of deep learning. It is often said that “everyone is an expert on his own language”, meaning we believe we have expertise simply because we have some level of performance. It seems that we can now state “everyone is an expert on IR”, meaning we believe we have expertise in IR simply because we can type a one-word query into a Google search box. There is more to IR than that.
Q1. This question was all about differences between ad-hoc and infrastructure wireless networks.

a. Few answers of any value. The point here is that there are no differences or very few in the physical layer. There are features such as carrier detection/assessment which may not be needed in contention-less infrastructure systems.

b. Here I hoped for sensible differences and there were some reasonable answers but few with examples.

c. Very few answers considered the obvious differences in routing between ad-hoc and infrastructure. One student dealt with this in the transport layer, I was not sure if it was a mistake or not.

d. Some good answers. Also some answers implying that UDP floods packets, it only does this for broadcast/multicast when used. This was an opportunity to talk about TCP variants for wireless use most of which work best when there is an access point with some intelligence.

e. Some good answers.

One issue appeared to be for all the layers that student’s are not sure what belongs in or close to each layer. There is also obvious confusion as to which functions occur in which layers. This should not be the case as each student has taken a curse in each year which worked layer to layer looking at protocols and functions.

I would have hoped to get more examples listed than were given. The 7 marks for examples should have been give away marks.

Q2 This question was about the 802.11 standard and also tested knowledge of wireless operation.

2.1 Mostly correct but a small number of absolute howlers.

2.2 I had expected to be told how the 54Mbps was arrived at. Some told me how wireless transmission happens, where relevant it got some marks.

2.3 Mostly good answers. Some only mentioned one effect causing 54Mbps to not be achieved, e.g. interference which matters but is not usually the most significant factor, whereas several others were expected.

2.4 Mostly good and some well though out answers.

2.5 A lot of reasonable but limited answers. It appears nobody knows the details of 802.11 operations. Hidden nodes are one example; exposed nodes are not as only on-air transmissions are in scope.

I was shocked that the overall marks were below 9 for this.

Q3 A question about mobile telephony.

3.1 Quite a few reasonable answers to this.

3.2 Quite a few reasonable answers to this.

3.3 A mixture of reasonable answers and those showing little knowledge.

3.4 Apart from the graph problem there were some good attempts at this in the textual part. The graph was scaled out due to a bug in the ABC software which many of the students experienced.

HLR is global - carrier wide. VLR is normally in MSC. VLR might move to new MSC. VLR is updated. It then updates the HLR.

Q3 marking adjustments

3.3. Some answers were very generic not naming the databases or their specific uses. One or two marks were given for handover related points made explicitly or implicitly in these.

3.4a had 4 marks but this part had to scaled out due to a software bug. The scaling used was
Several Q3 answers had points valid for other parts of the question only provided in the wrong place. A complete post-process scan was carried out to spot these and adjust the marks to take it into account. For example, at least one student with a blank answer for 3.2 was given a mark as a result of this.

**Comments:**

Q1. Quite well answered on the whole; big spread of marks.
Q2. Reasonably well answered.
Q3. Best answered question (by those who opted for it).
Q4. Pretty well answered on the whole.
Q5. Not answered.