INF PhD General Comprehensive Examination

Summer 2013

INSTRUCTIONS: This INF PhD General Comprehensive Exam consists of four questions. You must answer a total of one question.

The completed exam must be returned to Deborah Andersen (email dla@albany.edu) by 11:59 p.m. (midnight; 23:59) August 19, 2013.

In preparing your answers, you may use published or unpublished sources, the World Wide Web, or your own notes. However, you may not ask for or receive help on the exam from any person. You may make use of personal or mainframe computers in answering your question and you are expected to turn in an answer that is word-processed. Remember that the ability to present information clearly is one of the technical skills to be imparted in this program.

Your answer will be read anonymously by three different faculty members. Clearly label each page with the number of the question being answered. **DO NOT place your name on your pages; use your UAlbany ID number (the 9-digit system-generated number that is unique for each student) to identify your answer.** Each page should be numbered at the top with the number of the question, the number of the page of your answer, and your Albany ID number (e.g., Q.1, p.3, #000448221).

When you return the exam, you will be required to turn in the signed Honor Pledge statement (see next page) indicating that the exam is entirely your own work, and that you agree to keep the exam confidential. You should email a copy of the signed Honor Pledge to Deborah Andersen (email dla@albany.edu). **YOUR NAME AND SIGNATURE SHOULD APPEAR ONLY ON THIS HONOR PLEDGE.**
INF PhD General Comprehensive Exam
Summer 2013

Honor Pledge

I certify that I have completed the attached examination materials, constituting the general portion of the comprehensive examination in information science, using my own efforts. I have not asked for or received help from any person in completing this exam.

I agree not to discuss or divulge any information about this exam to anyone until after midnight 24:00) on August 19, 2013.

_______________________________________________________________________________

Signature                     ID number                     Date

_______________________________________________________________________________

Print or type your name
Question #1:
Electronic Media as “Technologies of Freedom”

In 1983 Ithiel de Sola Pool wrote Technologies of Freedom, a text that Tom Galvin\(^1\) loved and used in his information policy classes. In his last chapter de Sola Pool wrote:

Electronic media, as they are coming to be, are dispersed in use and abundant in supply. They allow for more knowledge, easier access, and freer speech than we ever enjoyed before. They fit in the free practices of print. The characteristics of media shape what is done with them, so one might anticipate that these technologies of freedom will overwhelm all attempts to control them. Technology, however, shapes the structure of the battle, but not every outcome. While the printing press was without doubt the foundation of modern democracy, the response to the flood of publishing that it brought forth has been censorship as often as press freedom. In some times and places the even more capacious new media will open wider the floodgates for discourse, but in other times and places, in fear of the flood, attempts will be made to shut the gates (251).

In your essay please take into account the above quotation and the questions that follow to create a balanced discussion (taking into account various points of view) in relation to information policy, management, technology, organization, and environments. This essay should not individually answer the questions below. Use the questions to direct your own organization of the issues, addressing the themes highlighted in the questions as well as how well de Sola Pool understood the future.

Are technologies really overwhelming all attempts to control them? What form does control take? Thirty years after the writing of this book is technology still shaping the structure of the battle? What other forces are at work or will be at work in the future? How clairvoyant was de Sola Pool in his assessment of the new media and the "floodgates of discourse"?

Should we attempt to distinguish in any systematic way between the conditions under which the floodgates will open and discourse will flourish and conditions under which attempts will be made to shut the gates? If so, what historical, social, cultural, and/or political factors are worth looking at? How should an informatics theorist proceed in an effort to answer these questions?

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\(^1\) Tom Galvin was the founding director of the INF PhD program at UAlbany. He was the creator of the first INF PhD comprehensive examinations.
Question #2:
IMLS Creating a Research Agenda for the Digital Public of America (DPLA)

Robert Darnton (2013) announced (a bit prematurely?) the launch of the Digital Public Library of America (DPLA). Previously, Darnton (2010) had laid out some of the parameters structuring the planning for the DPLA and earlier (Darnton, 2009 and 2011) had described the controversies around the Google Books project, one of the contributing factors leading to the launch of the DPLA.

This question centers around a future-possible (but now hypothetical) initiative within the Institute for Museum and Library Studies (IMLS), a national research organization similar to NSF and NIH, but with a mission to study museums and libraries. IMLS is preparing to launch a major new research program intended to support future development of the DPLA. The executive leadership of the IMLS has laid out five major areas where research will be needed: (1) Management of information related to the DPLA for administration of the initiative, (2) Organization of the information related to current and future development of the DPLA, (3) Information policy topics, including stakeholders, related to the DPLA, (4) Emerging technology issues related to the DPLA, and, finally (5) Ramifications of the DPLA for society as a whole, both nationally and internationally.

Your task is to draft a white paper for the eyes of the executive leadership of the IMLS that lays out multiple, major research issues/questions within each of these five categories. Each research issue should be phrased in such a way as to potentially lead to actionable results that can drive practical future developments for the DPLA. The executive leadership expects that you will identify 3 to 7 major research questions for each of the five major areas. Each question should be clearly delineated and defined with citations to major current literature pertaining to that topic. The text of your white paper will be reviewed by IMLS and will form the basis for a series of Requests for Proposals (RFPs) to be issued next year by the IMLS as part of its new program of research on the DPLA.

Articles pertinent to this question include:
The National Digital Public Library Is Launched! - The New York ...
Apr 25, 2013
Can We Create a National Digital Library? by Robert Darnton | The ...
www.nybooks.com/articles/.../can-we-create-national-digital-library/?...
Oct 28, 2010
www.nybooks.com/articles/.../dec/.../google-and-the-new-digital-future/?...
Google and the New Digital Future. December 17, 2009
Robert Darnton’s 6 Reasons Google Books Failed (New York Review)
www.huffingtonpost.com/.../robert-darnton-google-books_n_841533.ht...
Mar 28, 2011
Question #3:  
Timing and Cost of Product Manufacturing

Caution: This question bears a striking resemblance to one on an earlier Comprehensive Exam. Beware, it is NOT the same question. Unless otherwise stated, the term "algorithm" refers to a deterministic algorithm.

We have an unbounded collection of products, each of which can be manufactured by a process specific to that product. (The situation is idealized to make the question interesting; in practice, only some finite number of products can be handled.) It turns out that the products (and processes) can be associated in a one to one fashion with the positive integers. So we may indicate a listing of all the products as p(1), p(2), ..., p(k), ...

Each product requires a certain amount of time for its manufacture; these times are called t(1), t(2), ..., t(n). As we all know, time is money, so we can think of the t(i)'s as the cost of manufacturing the various products.

Now, there is an additional time cost associated with producing product p(j) immediately after producing p(i). This is because the facility must have been configured for producing p(i), and then reconfigured appropriately for producing p(j). So configuring the facility for p(j) is dependent not only upon p(j) but also upon the configuration from which the change is made. Let this "reconfigure cost" when going from p(i) to p(j) be denoted rc(i,j).

It is easy to organize all the reconfigure costs as a two-dimensional array in which rc(i,j) occupies the i-th row and j-th column. We will number the rows so that the bottom row is the first; the columns will be numbered from left to right. Note that in principle, the array is infinite and so goes up and to the right with no finite bound:

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. . . . . .
. . . . . .
. . . . . .
rc(3,1) rc(3,2) rc(3,3) rc(3,4) rc(3,5) . .
rc(2,1) rc(2,2) rc(1,3) rc(2,4) rc(2,5) . .
rc(1,1) rc(1,2) rc(1,3) rc(1,4) rc(1,5) . .
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A) While the notion of "reconfiguration cost" may be criticized as idealized and artificial, it might be a useful model for some "real world" scenarios. For example, consider the analysis of maintenance in production systems in the recent article, Arab, Ismail, and Lee (2013). "Maintenance scheduling incorporating dynamics of production system and real-time information from workstations," J. Intell. Manufacturing 24(4):695-705.
To what extent can reconfiguration costs as described here model maintenance costs and associated scheduling problems discussed in that article?

B) Are the number of products countable? Explain.

C) If we are given a (description of a) product, p*, is there an algorithm that will determine whether p* is one of the products that can be made? In other words, is there an algorithm that when given p*, can check whether there exists a positive integer k, such that p(k) = p*? Such an algorithm must answer correctly yes or no. Explain.

If the answer above is no, then is there an algorithm that can give a correct answer SOMETIMES, but not ALWAYS? Explain. (i.e., for what cases does the algorithm return the correct answer, and for what cases does it not?)

D) Are the number of reconfigure costs countable? Explain.

E) Discuss whether or not the diagonal must be all zeros in the reconfigure cost matrix above.

F) Suppose we have a set P of products and we want to consider the cost of manufacturing the members of P. Each member of P is equal to some p(i) for some positive integer i. So P can be represented as a set I of indices. As an example, if P = {p(3), p(8), p(121)}, then I = {3, 8, 121}. Regardless of the order in which the products of P are manufactured, the manufacturing cost is the same: (t(3)+t(8)+t(121)). But the total cost includes the reconfigure costs and is in general dependent upon the order in which the products are manufactured. In the example above, the reconfigure cost can be (rc(3,8)+rc(8,121)). (We assume zero reconfigure cost for starting with the first product.)

1) List the other possible reconfiguration costs for P.

2) Consider the index set {2,3,5,8,13,21}. How many different reconfiguration costs can there be for the associated set of products?

3) Given a set of N products, discuss how efficiently it can be decided whether the N products can be manufactured with a total reconfiguration cost less than or equal to some constant B. (Here, you may consider both deterministic and nondeterministic algorithms.)

4) Idealized question: Consider manufacturing ALL the infinitely many products, and consider all possible orders in which the products can be manufactured. Is the set of all such orders countable? Explain.
Question #4
Analysis of 25 Years of NSA Surveillance Programs

The recent Snowden leaks have drawn attention to the National Security Administration’s (NSA’s) program of national surveillance of messages sent by American citizens. But much of these surprising details have been well known for some time. This question invites you to respond to a (hypothetical) essay contest by the Annenberg Foundation for the Best Essay surveying the current state of NSA’s experience with surveillance with an emphasis on the reforms being proposed by President Obama. In 1978, the foreign Intelligence Surveillance Act (FISA) was passed by Congress. That act set up the Foreign Intelligence Surveillance Court (FISC). It now appears that the dramatic “leaks” represent technically legal actions—the Obama administration alleges that the programs that were leaked to the public have, indeed, been reviewed and approved by the FISC. In 1975 Senator Frank Church, the Idaho Democrat who was then chairman of the select committee on intelligence and champion of the FISA legislation wrote about NSA’s emerging capability,

That capability at any time could turn around on the American people and no American would have any privacy left, such [is] the capability of monitoring everything: Telephone conversations, telegrams, it doesn’t matter. There would be no place to hide: If this government ever became a tyranny, if a dictator every took charge in this country, the technological capacity that the intelligence community has given the government could enable it to impose total tyranny, and there would be no way to fight back, because the most careful effort to combine together in resistance to the government, no matter how privately it was done, is within the reach of the government to know. Such is the capability of this technology…I don’t want to see this country ever go across the bridge.

I know the capacity that is there to make tyranny total in America, and we must see to it that this agency and all agencies that possess this technology operate within the law and under proper supervision, so that we never cross over the abyss. That is the abyss from which there is no return.


On August 9, 2013, President Obama, while expressing his confidence that NSA’s programs have not and will not “cross over the abyss,” delivered a four point plan to increase the public’s trust in NSA’s surveillance programs. The text of his remarks are attached to this question.

The essay contest being sponsored by the Annenberg Foundation invites you to take Senator Church’s statement in 1975 and President Obama’s remarks in 2013 as jumping off points for drafting an academic essay suitable for publication in an academic journal that features “thought pieces” (such as First Monday, or Pantaneto Forum). Your essay should reflect on NSA’s programs of domestic surveillance with specific attention to President Obama’s four point plan for reform. The Foundation is interested in a balanced essay that views these programs and the President’s four proposals from five inter-related points of view:
1. **Technology.** What are the trends in technology that are enabling these new surveillance capabilities? What future technologies now on the horizon might make surveillance into a more complicated issue? Or might new technologies provide a solution to some of the current programs.

2. **Societal Impact.** What are the impacts on our society of the NSA surveillance programs?

3. **Public and Information Policy.** What are the current and future issues raised by the NSA surveillance program from a public and information policy point of view?

4. **Management of Information within the National Security apparatus.** The NSA is an organization like any other organization that functions with a mission to provide public security through the collection of intelligence. How should the NSA be managing its information assets under the Obama proposals? How is the changing nature of information holdings shaping the management of the NSA?

5. **Information Organization.** Increasingly information in our society is moving out of structured formats such as data bases to more distributed, often cloud-based formats. While e-mail and the telephone remain important means of exchanging person-to-person messages, new techniques based on social computing are also shaping how we as a society organize our information-based communications.

Of course, these five themes overlap and are inter-dependent. Indeed, no single essay could do justice to a complete academic survey of all these issues with citations to appropriate sources. Hence, the challenge for this essay is to select a point of view on the NSA surveillance program that cuts across these five key programs and write a well-cited and exciting academic think piece that comments on the NSA’s current surveillance programs with a special emphasis on President Obama’s four proposals for reform. Your essay should be cogent/readable by an informed layperson while at the same time grounded in current literature in information science.
President Obama announced Friday afternoon that his administration would change the Patriot Act and other aspects of surveillance programs.

3:09 P.M. EDT

THE PRESIDENT: Good afternoon, everybody. Please have a seat.

Over the past few weeks, I’ve been talking about what I believe should be our number-one priority as a country — building a better bargain for the middle class and for Americans who want to work their way into the middle class. At the same time, I’m focused on my number-one
responsibility as Commander-in-Chief, and that’s keeping the American people safe. And in recent days, we’ve been reminded once again about the threats to our nation.

As I said at the National Defense University back in May, in meeting those threats we have to strike the right balance between protecting our security and preserving our freedoms. And as part of this rebalancing, I called for a review of our surveillance programs. Unfortunately, rather than an orderly and lawful process to debate these issues and come up with appropriate reforms, repeated leaks of classified information have initiated the debate in a very passionate, but not always fully informed way.

Now, keep in mind that as a senator, I expressed a healthy skepticism about these programs, and as President, I’ve taken steps to make sure they have strong oversight by all three branches of government and clear safeguards to prevent abuse and protect the rights of the American people. But given the history of abuse by governments, it’s right to ask questions about surveillance — particularly as technology is reshaping every aspect of our lives.

I’m also mindful of how these issues are viewed overseas, because American leadership around the world depends upon the example of American democracy and American openness — because what makes us different from other countries is not simply our ability to secure our nation, it’s the way we do it — with open debate and democratic process.

In other words, it’s not enough for me, as President, to have confidence in these programs. The American people need to have confidence in them as well. And that’s why, over the last few weeks, I’ve consulted members of Congress who come at this issue from many different perspectives. I’ve asked the Privacy and Civil Liberties Oversight Board to review where our counterterrorism efforts and our values come into tension, and I directed my national security team to be more transparent and to pursue reforms of our laws and practices.

And so, today, I’d like to discuss four specific steps — not all inclusive, but some specific steps that we’re going to be taking very shortly to move the debate forward.

First, I will work with Congress to pursue appropriate reforms to Section 215 of the Patriot Act — the program that collects telephone records. As I’ve said, this program is an important tool in our effort to disrupt terrorist plots. And it does not allow the government to listen to any phone calls without a warrant. But given the scale of this program, I understand the concerns of those who would worry that it could be subject to abuse. So after having a dialogue with members of Congress and civil libertarians, I believe that there are steps we can take to give the American people additional confidence that there are additional safeguards against abuse.

For instance, we can take steps to put in place greater oversight, greater transparency, and constraints on the use of this authority. So I look forward to working with Congress to meet those objectives.
Second, I’ll work with Congress to improve the public’s confidence in the oversight conducted by the Foreign Intelligence Surveillance Court, known as the FISC. The FISC was created by Congress to provide judicial review of certain intelligence activities so that a federal judge must find that our actions are consistent with the Constitution. However, to build greater confidence, I think we should consider some additional changes to the FISC.

One of the concerns that people raise is that a judge reviewing a request from the government to conduct programmatic surveillance only hears one side of the story — may tilt it too far in favor of security, may not pay enough attention to liberty. And while I’ve got confidence in the court and I think they’ve done a fine job, I think we can provide greater assurances that the court is looking at these issues from both perspectives — security and privacy.

So, specifically, we can take steps to make sure civil liberties concerns have an independent voice in appropriate cases by ensuring that the government’s position is challenged by an adversary.

Number three, we can, and must, be more transparent. So I’ve directed the intelligence community to make public as much information about these programs as possible. We’ve already declassified unprecedented information about the NSA, but we can go further. So at my direction, the Department of Justice will make public the legal rationale for the government’s collection activities under Section 215 of the Patriot Act. The NSA is taking steps to put in place a full-time civil liberties and privacy officer, and released information that details its mission, authorities, and oversight. And finally, the intelligence community is creating a website that will serve as a hub for further transparency, and this will give Americans and the world the ability to learn more about what our intelligence community does and what it doesn’t do, how it carries out its mission, and why it does so.

Fourth, we’re forming a high-level group of outside experts to review our entire intelligence and communications technologies. We need new thinking for a new era. We now have to unravel terrorist plots by finding a needle in the haystack of global telecommunications. And meanwhile, technology has given governments — including our own — unprecedented capability to monitor communications.

So I am asking this independent group to step back and review our capabilities — particularly our surveillance technologies. And they’ll consider how we can maintain the trust of the people, how we can make sure that there absolutely is no abuse in terms of how these surveillance technologies are used, ask how surveillance impacts our foreign policy — particularly in an age when more and more information is becoming public. And they will provide an interim report in 60 days and a final report by the end of this year, so that we can move forward with a better understanding of how these programs impact our security, our privacy, and our foreign policy.

So all these steps are designed to ensure that the American people can trust that our efforts are in line with our interests and our values. And to others around the world, I want to make clear once again that America is not interested in spying on ordinary people. Our intelligence is
focused, above all, on finding the information that’s necessary to protect our people, and — in many cases — protect our allies.

It’s true we have significant capabilities. What’s also true is we show a restraint that many governments around the world don’t even think to do, refuse to show — and that includes, by the way, some of America’s most vocal critics. We shouldn’t forget the difference between the ability of our government to collect information online under strict guidelines and for narrow purposes, and the willingness of some other governments to throw their own citizens in prison for what they say online.

And let me close with one additional thought. The men and women of our intelligence community work every single day to keep us safe because they love this country and believe in our values. They’re patriots. And I believe that those who have lawfully raised their voices on behalf of privacy and civil liberties are also patriots who love our country and want it to live up to our highest ideals. So this is how we’re going to resolve our differences in the United States — through vigorous public debate, guided by our Constitution, with reverence for our history as a nation of laws, and with respect for the facts.