Datalogiens Videnskabsteori 2009
Eksamensspørgsmål (ordinær eksamen)

Henrik Kragh Sørensen

15. juni 2009

Eksamensspørgsmålene udleveres mandag 15. juni kl. 12.00 på AULA og fra kontoret på Institut for Videnskabsstudier (1110-119).

Eksamensbesvarelserne afleveres **i to eksemplarer** på kontoret på Institut for Videnskabsstudier **senest onsdag 17. juni kl. 12.00**.

Husk også at udfylde en afleveringskvittering.

Der skal **vælges præcist ét af følgende to eksamenssæt**. Angiv klart, hvilke eksamenssæt, der besvares.

Sæt 1

Svar på følgende 5 spørgsmål:

1. Redegør for Kuhns model for videnskabelige fremskridt på grundlag af Lohsee 1993 og evt. Andersen 2003.
2. Fremdrag og analysér mindst to forskelle mellem Kuhns og Lakatos' modeller.
3. Læs det vedhæftede tekststykke Bolter 1986, pp. 12–14 og redegør kort for dets centrale pointe(r), herunder for ideen om "Turing's Man".
4. Analysér forskelle mellem "stærk (eller klassisk eller traditionel) kunstig intelligens" og "ny kunstig intelligens" som beskrevet af Strom og Darden 1996 og Johansen 2003.
5. Diskutér forskellige tilgange til kunstig intelligens i forhold til Bolters ide om "Turing's Man".

Sæt 2

Svar på følgende 5 spørgsmål:

1. Redegør på grundlag af Ensmenger 2003 for "software-krisen" i slutningen af 1960'erne.
2. Analysér på grundlag af Ensmenger mulige konflikter mellem forskellige medarbejdergruppers interesser i softwarebranchen.

3. Redegør for forskelle mellem nytteetik og pligetik som normative etiske positioner på grundlag af Johnson 2001.
4. Udvælg en professionsetisk case fra teksterne Anderson m.fl. 1993 eller Berenbach og Broy 2009 og analysér den i forhold til loyalitetsspørgsmål.
5. Diskutér den professionsetiske case i forhold til normative etiske positioner.

Pensum udgøres af kompendiet hørende til Datalogiens videnskabsteori 2009 samt notesættet "Noter til Datalogiens videnskabsteori 2009" Sørensen 2009, version 1.13, 4. maj 2009. Tekstnumre i opgaveformuleringerne henviser til dette kompendium.

Referencer

Andersen, Hanne (2003). "Videnskabelige revolutioner". I: *Aktuel Naturvidenskab* 2 (maj 2003). S. 31–33.

Anderson, Ronald E. m.fl. (1993). "Using the New ACM Code of Ethics in Decision Making". I: *Communications of the ACM* 36.2 (feb. 1993). S. 98–107.

Berenbach, Brian og Manfred Broy (2009). "Professional and Ethical Dilemmas in Software Engineering". I: *IEEE Computer* 42.1 (jan. 2009). S. 74–80.

Bolter, J. David (1986). *Turing's Man: Western Culture in the Computer Age*. Først offentliggjort: 1984. London etc.: Penguin Books.

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Johnson, Deborah G. (2001). "Philosophical Ethics". I: *Computer Ethics*. 3. udg. Upper Saddle River (NJ): Prentice Hall. Kap. 2, s. 26–53.

Lohsee, John (1993). "Theories of Scientific Progress". I: *A Historical Introduction to the Philosophy of Science*. Oxford & New York: Oxford University Press. Kap. 14, s. 222–236.

Strom, John D. og Lindley Darden (1996). "Is artificial intelligence a degenerating program?: A review of Hubert Dreyfus' *What Computers Still Can't Do*". I: *Artificial Intelligence* 80.1. S. 151–170.

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obeyed the laws of mathematics was clear, accessible, and therefore powerful because his contemporaries lived with clocks and gears. So today electronic technology gives a more catholic appeal to a number of trends in twentieth-century thought, particularly the notions of mathematical logic, structural linguistics, and behavioral psychology. Separately these trends were minor upheavals in the history of ideas; taken together, they become a major revision in our thinking.

Turing's Man

In the development of the computer, theory preceded practice. The manifesto of the new electronic order of things was a paper ("On Computable Numbers") published by the mathematician and logician A. M. Turing in 1936. Turing set out the nature and theoretical limitations of logic machines before a single fully programmable computer had been built. What Turing provided was a symbolic description, revealing only the logical structure and saying nothing about the realization of that structure (in relays, vacuum tubes, or transistors). A Turing machine, as his description came to be called, exists only on paper as a set of specifications, but no computer built in the intervening half century has surpassed these specifications; all have at most the computing power of Turing machines. Turing is equally well known for a very different kind of paper; in 1950 he published "Computing Machinery and Intelligence." His 1936 work was a forbidding forest of symbols and theorems, accessible only to specialists. This later paper was a popular polemic, in which Turing stated his conviction that computers were capable of imitating human intelligence perfectly and that indeed they would do so by the year 2000. This paper too has served as a manifesto for a group of computer specialists dedicated to realizing Turing's claim by creating what they call "artificial intelligence," a computer that thinks.

Put aside for the moment the question of whether the computer can ever rival human intelligence. The important point is that Turing, a brilliant logician and a sober contributor to the advance of electronic technology, believed it would and that many have followed him in that belief. The explanation is partly enthusiasm for a new invention. In 1950 the computer was just beginning to bring vast areas of science and business under its technological

aegis. These machines were clearly taking up the duties of command and control that had always been assumed by human operators. Who could say then where the applications of electronic command and control might end? Was it not natural to believe that the machine would in time eliminate the human operator altogether? Inventors, like explorers, have a right to extravagant claims. Edison had said that the record player would revolutionize education; the same claim was made for radio and, of course, television.

I think, however, that Turing's claim has had a greater significance. Turing was not simply exaggerating the service his machine could perform. (Does a machine that imitates human beings perform any useful service at all? We are not running short of human beings.) He was instead explaining the meaning of the computer for our age. A defining technology defines or redefines man's role in relation to nature. By promising (or threatening) to replace man, the computer is giving us a new definition of man, as an "information processor," and of nature, as "information to be processed."

I call those who accept this view of man and nature Turing's men. I include in this group many who reject Turing's extreme prediction of an artificial intelligence by the year 2000. We are all liable to become Turing's men, if our work with the computer is intimate and prolonged and we come to think and speak in terms suggested by the machine. When the cognitive psychologist begins to study the mind's "algorithm for searching long-term memory," he has become Turing's man. So has the economist who draws up input-output diagrams of the nation's business, the sociologist who engages in "quantitative history," and the humanist who prepares a "key-word-in-context" concordance.

Turing's man is the most complete integration of humanity and technology, of artificer and artifact, in the history of the Western cultures. With him the tendency, implicit in all eras, to think "through" one's contemporary technology is carried to an extreme; for him the computer reflects, indeed imitates, the crucial human capacity of rational thinking. Here is the essence of Turing's belief in artificial intelligence. By making a machine think as a man, man recreates himself, defines himself as a machine. The scheme of making a human being through technology belongs to thousands of years of mythology and alchemy, but Turing and his followers have given it a new twist. In Greek mythology, in the story of Pygmalion and Galatea, the artifact, the

perfect ivory statue, came to life to join its human creator. In the seventeenth and eighteenth centuries, some followers of Descartes first suggested crossing in the other direction, arguing, with La Mettrie, that men were no more than clockwork mechanisms. Men and women of the electronic age, with their desire to sweep along in the direction of technical change, are more sanguine than ever about becoming one with their electronic homunculus. They are indeed remaking themselves in the image of their technology, and it is their very zeal, their headlong rush, and their refusal to admit any reservation that calls forth such a violent reaction from their detractors. Why, the critics ask, are technologists so eager to throw away their freedom, dignity, and humanity for the sake of innovation?

Should we be repelled by the notion of man as computer? Not until we better understand what it means for man to be a computer. Why on the face of it should we be more upset by this notion than by the Cartesian view that man is a clock or the ancient view that he is a clay vessel animated by a divine breath? We need to know how Turing's man differs from that of Descartes or Plato, how the computer differs conceptually and symbolically from a clock or a clay pot. And to do this, we must isolate the precise qualities of computers and programming, hardware and software, that have the magnifying effect mentioned earlier—bringing ideas from philosophy and science into a new focus.