Queen Mary
University of London

**Coursework sheet 1 - Literature Search**
**Template Solution and Marking Scheme**

This document provides a minimal template solution: other solutions can also be correct, including more elaborated ones.

**1.** (7 marks) **Percolation theory**

(a) [1 mark for reference, 1 mark for explanation of search.]

The reference is: Harry Kesten, The critical probability of bond percolation on the square lattice equals 1/2. *Comm. Math. Phys.* **74**, 1 (1980), pp.41-59. (It is allowed to abbreviate the authors first names or the journal name (the real name being *Communications in Mathematical Physics*). While a complete reference must contain volume number and year, we are generous with the issue number here, if you didn't mention it.)

The paper can be found in many ways, using search techniques we explained in the course (on Math Sci Net, ArXiv, Google Scholar etc.) or – as this is a famous paper – also Wikipedia (in the page of Kesten) and many other internet sources.

(b) [1 mark for reference, 1 mark for explanation of search.]
The reference is: Broadbent, S.R., Hammersley, J.M. : Percolation processes. I, II. *Proc. Cambridge Philos. Soc.* **53**, 629-641 and 642-645 (1957). We would accept either the first of these, or them both (they are really two parts of one larger paper.

By far the easiest way to find it is to look at the introduction to the Kesten paper. Its first line says "Broadbent and Hammersley [2], introduced the following percolation problem."

Also, note that the reference as stated in Kesten's paper, incorrectly gives the year as 1979. We accepted that as the answer as you were not expected to check that the reference given was correct. However, if you pointed out the discrepancy then we gave a bonus mark. More generally, you should be aware references are not always correct.

(c) [1 mark for 2 names, 1 for explanation.]
J.M. Hammersley and T.E. Harris (surnames would suffice) are two easy examples: they are both cited as having proved things about the critical probability in the first page of the Kesten paper.

(d) [1 mark]
The reference is Kesten, H.; Runnenburg J., Some elementary proofs in renewal theory with applications to waiting times. Afdeling Rep. S 203 *Math. Centrum Amsterdam. Statist* (1956).

(We would accept either of the other of his 1956 papers as it is not clear in which order the 1956 papers were published.)

**2.** (7 marks) **Network Science**

(a) [2 marks] DJ Watts and SH Strotatz, Collective dynamics of 'small-world' networks, *Nature* **393** (1998) pp.440-442. This is the paper where the concept of a complex network (as a large graph whose topology interpolates between regular and random) was first proposed. We also accepted the Barabasi & Albert paper (AL Barabasi, R Albert, Emergence of Scaling in Random Networks, *Science* **286** (1999), pp. 509-512).

(b) [1 mark]
According to Google Scholar estimation, this paper has been cited 27308 times as per Friday 23 October 2015. Other sources give different numbers.

(c) [2 marks] A simple proxy for a field is the name of the journal. So one can, in a first approximation, assume that a paper published in a physics journal is a paper about physics, etc (although this is not necessarily the case sometimes). If you want to be more careful, you can go and read in a diagonal way your initial selection of papers to focus really on papers that use network science to deal with purely physical, economical and biological problems. A possible solution is:
- Physics: D. Krioukov, M. Kitsak, R.S. Sinkovits, D. Rideout, D. Meyer & M. Boguna, Network Cosmology, *Sci. Rep.* **2**, 793 (2012)
- Economy - Bonanno, G., Caldarelli, G., Lillo, F., Micciche, S., Vandewalle, N. and Mantegna, R.N., Networks of equities in financial markets, *Eur. Phys. J. B* **38**, 2 (2004) pp 363-371. Note the topic of this paper is finance, but it is published in a physics journal!
- Biology - R. Guimera and LAN Amaral, Functional cartography of complex metabolic networks, *Nature* **433** (2005) pp.895-900

(d) [2 marks] This can be done looking at Profiles in Google Scholar that belong to the Network Science community. Albert-Laszlo Barabasi ($>$ 135000 citations), Duncan J Watts ($>$ 59000 citations), Don Towsley ($>$ 52000 citations) are possible solutions. Some people gave papers with this number of citations – that was not the question so lost marks.

**3.** (6 marks) **Number theory**

(a) [1 mark for URL and 1 for journal]
`http://arxiv.org/abs/math/0404188`. It appeared in the Annals of Mathematics. (This is the most prestigious pure maths journal).

Note some people gave a lot of extraneous information – for example a full reference. In some cases this lost marks: you were asked for the journal so you should explicitly give the name of the journal.

Also note that you should get the name correct: e.g., 'The Annual of Mathematics' is not the same.

(b) [1 mark for each date]
The first version appeared on arxiv in 2004. It was published in the Annals of Maths in 2008. (You see an example of the long delay in pure maths that can occur even for a 'top' paper.)

Note that 'published' always refers to the official publication date as given in the citation. Not some 'online publication date' or similar.

(c) [1 mark for each reference (with a method)]
This paper has a large number of citations: mathscinet gives 131; google scholar lists 597.

**General remark.** Bonus points might be given for particularly well written explanations, good insights and remarks. You can at most receive 2 bonus points (and a second one is less generously given than a first one). Moreover, your final mark (the sum of the marks and bonus points) can not be higher than 20 – so while you can use bonus points to make up for little weaknesses in this coursework sheet, they will not carry over to future coursework sheets (and are lost in case you score more than the full 20 marks).
In the same vein, you can receive negative points for particularly sloppy documents.