Queen Mary, University of London

MAE113 Discrete Techniques for Computing, 2007.
SAMPLE MID-TERM TEST.

Time allowed - 40 minutes.

Counting 100 marks for the whole test, each question is worth 20 marks.

In the actual test, questions will be on separate sheets with instructions:

Write your answer on the same page after each part of each question.

Use the backs of the sheets for rough work. No CALCULATORS.

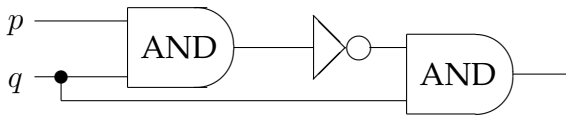
.....

1. (a) Let $X = \{0, 1, 2, 3\}$ and let $Y = \{0, 3, 6, 9\}$. List the elements in the set $X \cap Y$ and calculate the number $|X \cup Y|$.

   (b)There are three sets A, B, C and you are told that
   $|A| = 100,\ \ |B| = 30,\ \ |C| = 34,\ \ |A \cap B| = 6,\ \ |A \cap C| = 23,$
   $|B \cap C| = 8,\ \ |A \cap B \cap C| = 3.$

   Calculate $|A \cup B \cup C|$. You should use the principle of inclusion-exclusion and show your workings.

2. Find the output of the following logic circuit in the following way: First work out the boolean formula of the circuit and then calculate the truth table of this formula.



3. (a) Find a simpler proposition equivalent to the proposition $pqrs \vee p'qrs' \vee pq'rs \vee p'qr's'$.

   (b) Find a boolean formula which is equivalent to the following formula and is a disjunction of one or more minterms:
   $(p \leftrightarrow q) \vee (q'p)$.

4. (a) Convert 431 (in the decimal system) to the corresponding number in the binary system.

   (b) Multiply the binary numbers 1101101×10101.

5. Answer (a) and (b) for modular arithmetic in $\mathbb{Z}_{11} = \{[0], [1], [2], [3], [4], [5], [6], [7], [8], [9], [10]\}$.

   (a) Simplify the expression: $[5] + ([2] \times [6]) + [8]([1] - [5])$.

   (b) Find $[n]$ in $\mathbb{Z}_{11}$ satisfying the equation $[3][n] = [5]$.