# 1995 Paper 2 Questions 1–20

Twenty-part question (*One mark per part*)

1 A and B are finite sets with $|A| = m$, and $|B| = n$. How many partial functions are there from A to B? Why?

2 How many different ways are there to make up a basket of 15 fruit from apples, pears, oranges and bananas?

3 Explain, without writing a program, Euclid's algorithm for greatest common divisor.

4 Simplify $(A \vee B) \wedge (\overline{A} \vee B) \wedge (A \vee \overline{B})$.

5 Given a distribution $P(X = r) = \frac{\lambda^r}{r!} e^{-\lambda}$, what is the expectation $E(X)$?

6 What is the probability that the scores on two dice sum to 8?

7 Following the ML definition `fun tw f x = f(f(x))`, what is the type of `tw`?

8 Can the following circuit exhibit a static hazard and if so when?
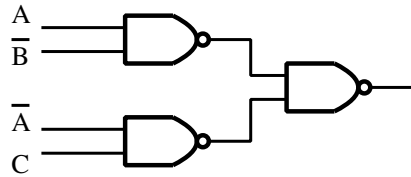
9 What is a tri-state buffer, how does it differ from more ordinary logic gates and how is it used?

10 Given a `CARDINAL` variable `n`, write Modula-3 code to declare and initialise a variable `p` to point to an array of `n` `REAL`s.

11 Write a Modula-3 type definition for a linked list of `INTEGER`s.

12 Following the ML definition `fun f g [y,z] = g(y+1, z)` what is the type of `f`?

13 What three new offences were created under the Computer Misuse Act of 1990?

14 Systems engineers use the terms "availability" and "reliability". Explain the distinction they make between them.

15 List *four* essential differences between a software engineering project and a civil engineering project such as building a skyscraper.

16 Verify $(A \cup B) \setminus (A \cap B) = (A \cap \overline{B}) \cup (\overline{A} \cap B)$.

17 A, B, C are arbitrary events which occur with probability $P(A)$, $P(B)$, and $P(C)$. Write an expression for the event that only one of them occurs. You do not need to express its probability.

18 If the probability of having a boy is $\frac{1}{2}$ what is the probability that a family of 4 children has more boys than girls? (Ignore the possibility of multiple births.)

19 Give a finite *deterministic* automaton with alphabet of input symbols $\{a, b\}$ that accepts the language denoted by the regular expression a^*.

20 If L is a regular language over an alphabet Σ, explain why the complement $\{w \in \Sigma^* | w \notin L\}$ is also a regular language.