# 2001 Paper 10 Question 13

## Numerical Analysis I

For IEEE Single Precision $\beta = 2$, $p = 24$, $e_{\max} = +127$, $e_{\min} = -126$. Explain these parameters. How many bits are required to store the *exponent* and the *significand*, respectively? How is the exponent stored? [6 marks]

By means of a table, or otherwise, describe how the following quantities are represented: *zero*, *denormal numbers*, *normalised numbers*, *infinities* and *Not a Number* (*NaN*). [5 marks]

Let $\omega$ represent any of the operations $+ - * $ or $/$. Let $x$ be any normalised or denormal number or $\pm$ 0. Writing $n$ for any *NaN* value, what do the following evaluate to?

$(a)$ $x \ \omega \ n$

$(b)$ $\pm \infty \ \omega \ n$

$(c)$ $x \ \omega \ \pm \ \infty$

$(d)$ $\sqrt{\pm \infty}$

[6 marks]

Let $z$ be the smallest representable positive normalised number. What are the values of the following?

$(e)$ $z$

$(f)$ the largest representable number smaller than $z$

$(g)$ the smallest representable positive number

[3 marks]