

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, communication with others, scratchpaper, etc.

For this page of the quiz, assume you have a base 2 computer that stores floating point numbers using a 5 bit normalized mantissa (x.xxxx), a 4 bit exponent, and a sign for each. Assume that all numbers are chopped rather than rounded.

1a. (5) Give the machine representation and a base 10 representation for the smallest nonzero positive number.

Answer: The mantissa is as small as possible, +1.0000 and the exponent is as small as possible, -1111. This is 2^{-15} .

1b. (5) What range of real numbers has the same representation as 16.625 if numbers are converted to binary, chopped, and then stored?

Answer: $16.625_{10} = 10000.101_2$. This would be stored as 1.0000×2^4 . The next larger floating point number is $1.0001 \times 2^4 = 17$. Therefore, the range is $[16, 17)$.

2. (5) What is the relative error in 2.14 as an approximation to 2.14836?

Answer: $(2.14836 - 2.14) / 2.14836$.

3. (5) Define backward error analysis.

Answer: It is the process of bounding the distance between the given problem and the problem actually solved.