Representation of Real Numbers
Problem A

If p=1, e_{min} = -1 and e_{max} = 1

1) List the possible *positive* floating point numbers.

2) Can the following numbers or expressions be represented (exactly)? If not, why not?

50
500
55
0.05 * .5

3) If x = 14.5, what is the

roundoff error

relative error

Representation of Real Numbers
Problem A - Answers

If p=1, e_{min} = -1 and e_{max} = 1

1) List the possible *positive* floating point numbers.

0.1, 0.2, …0.9, 1, 2, 3, …9, 10, 20, 30, …90

2) Can the following numbers or expressions be represented (exactly)? If not, why not?

50 - yes
500 - no neither 50 x 10^1 or 5 x 10^2 are allowed
55 - no, this requires a two-digit mantissa
0.05 * .5 - 0.0025 requires a two-digit mantissa and it's less than 0.1

3) If x = 14.5, what is the

roundoff error |14.5 – 10| = 4.5
relative error 4.5 / 14.5 = 0.31

Representation of Real Numbers
Problem B

1) Assume we change p to 2 in Problem A so that we can have 2-digit mantissas. Now, for the range [10..100), we can support every whole number, i.e., 10, 11, 12,... 98, 99.

   If x = 14.5, what is the

   roundoff error

   relative error

2) With p=2, now set e_{min} = -2 and e_{max} = 2.

   What is the largest floating point number that can be represented?

Representation of Real Numbers
Problem B - Answers

1) Assume we change p to 2 in Problem A so that we can have 2-digit mantissas. Now, for the range [10..100), we can support every whole number, i.e., 10, 11, 12,... 98, 99.

   If x = 14.5, what is the

   roundoff error $|14.5 - 14| = 0.5$

   relative error $0.5 / 14.5 = 0.034$

2) With p=2, now set e_{min} = -2 and e_{max} = 2.

   What is the largest floating point number that can be represented?

   $9.9 \times 10^2 = 990$ note: the mantissa is in the range [1.0 ..10.0)