Problems with Answers for ACMS 60690

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1 August 24, 2012: Due August 29, 2012

Problem 1.1 *Using 3-digit arithmetic compute*

$$(1.72 + 0.005) + 0.002$$
$$1.72 + (0.005 + 0.002)$$
$$(1.73 + 0.005) + 0.002$$
$$1.73 + (0.005 + 0.002)$$

using chopping and using round to even. In each case compute the relative error.

Answer

- Chopping
  - $(1.72+0.005)+0.002 = 1.72$ with absolute error 0.007 and relative error $0.007/1.727$.
  - $1.72+(0.005+0.002) = 1.72$ with absolute error 0.007 and relative error $0.007/1.727$.
  - $(1.73+0.005)+0.002 = 1.73$ with absolute error 0.007 and relative error $0.007/1.727$.
  - $(1.73 + (0.005 + 0.002) = 1.73$ with absolute error 0.007 and relative error $0.007/1.737$.
- Rounding to even:
  - $(1.72+0.005)+0.002 = 1.72$ with absolute error 0.007 and relative error $0.007/1.727$.

- $1.72+(0.005+0.002) = 1.73$ with absolute error 0.007 and relative error $0.003/1.727$.
- $(1.73+0.005)+0.002 = 1.74$ with absolute error 0.007 and relative error $0.003/1.737$.
- $(1.73 + (0.005 + 0.002) = 1.74$ with absolute error 0.007 and relative error $0.007/1.727$.

Problem 1.2 *A person wishes to find a zero of* $f(x) = x^3 - 5$ *for* $1 \leq x \leq 2$. *That person decides to use the bisection method to accomplish this.*

1. *What are the first 3 approximations using the bisection method?*
2. *You would like to find an approximation to a zero of* $f(x)$ *on* $[1, 2]$ *with an absolute error of no more than* 0.001. *Using the bisection method and the error estimate for the bisection method, which is the smallest integer* n *for which you know that on the* n*-th approximation you will be within* 0.001 *of the correct answer. Compute this approximation.*

Answer See Homework1.pdf.

Problem 1.3 *A person wishes to find a zero of* $f(x) = x^3 - 5$ *for* $1 \leq x \leq 2$. *That person decides to use Newton's method for finding a solution of the equation* $f(x) = 0$ *on the interval,* $[1, 2]$.

1. *Write down the iteration formula that Newton's method gives for solving* $f(x) = 0$. *Then using 80 digit arithmetic with* 2.0 *as a starting guess, find the first six approximations to a solution of* $f(x) = 0$ *given by this formula.*
2. *How do these approximations compare with the tenth approximation of the bisection method computed in the previous problem.*

Answer See Homework1.pdf.

Problem 1.4 *A person wishes to find a zero of* $f(x) = x^3 - 5$ *for* $1 \leq x \leq 2$. *That person decides to use the secant method for finding a solution of the equation* $f(x) = 0$ *on the interval,* $[1, 2]$.

1. *Write down the iteration formula that the secant method gives for solving* $f(x) = 0$. *Then using 32 digit arithmetic with* $1.0, 2.0$ *as the starting guesses, find the first six approximations to a solution of* $f(x) = 0$ *given by this formula.*

2. *For i from 1 to 6, compare the i-th approximation with the i-th approximation by Newton's method.*

Answer See Homework1.pdf.