Math 4670 Homework One

1. Write a Fortran program to determine the largest integer that your system can represent, and report your result. Note that there should be no variables of type real, and no numbers with decimal points.

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! Determine the largest integer that your system can represent and report the results.

! There should be no variables of type real and no numbers with decimal points.

implicit none

integer::i, big

big = 1

do i = 1, 50

big = big \* 2

print\*, big

end do

stop

end

Running this produced the following results:

2

4

8

16

32

64

128

256

512

1024

2048

4096

8192

16384

32768

65536

131072

262144

524288

1048576

2097152

4194304

8388608

16777216

33554432

67108864

134217728

268435456

536870912

1073741824

-2147483648

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

At this time the reason we are getting zero at the end for the estimate is not known to us.

1. Since there are only a finite number of real values in our computer number system, there must be a smallest possible real variable value. Write a program to estimate this number. This is very similar in spirit to our calculation of the biggest real value, but now we want small values. Be sure to display your result.

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! Determine the smallest possible real variable value.

implicit none

real::small

integer::i

small = 1

do i = 1, 150

small = small / 2

print\*, small

end do

stop

end

Running this produced the following results:

0.500000

0.250000

0.125000

6.250000E-02

3.125000E-02

1.562500E-02

7.812500E-03

3.906250E-03

1.953125E-03

9.765625E-04

4.882813E-04

2.441406E-04

1.220703E-04

6.103516E-05

3.051758E-05

1.525879E-05

7.629395E-06

3.814697E-06

1.907349E-06

9.536743E-07

4.768372E-07

2.384186E-07

1.192093E-07

5.960464E-08

2.980232E-08

1.490116E-08

7.450581E-09

3.725290E-09

1.862645E-09

9.313226E-10

4.656613E-10

2.328306E-10

1.164153E-10

5.820766E-11

2.910383E-11

1.455192E-11

7.275958E-12

3.637979E-12

1.818989E-12

9.094947E-13

4.547474E-13

2.273737E-13

1.136868E-13

5.684342E-14

2.842171E-14

1.421085E-14

7.105427E-15

3.552714E-15

1.776357E-15

8.881784E-16

4.440892E-16

2.220446E-16

1.110223E-16

5.551115E-17

2.775558E-17

1.387779E-17

6.938894E-18

3.469447E-18

1.734723E-18

8.673617E-19

4.336809E-19

2.168404E-19

1.084202E-19

5.421011E-20

2.710505E-20

1.355253E-20

6.776264E-21

3.388132E-21

1.694066E-21

8.470329E-22

4.235165E-22

2.117582E-22

1.058791E-22

5.293956E-23

2.646978E-23

1.323489E-23

6.617445E-24

3.308722E-24

1.654361E-24

8.271806E-25

4.135903E-25

2.067952E-25

1.033976E-25

5.169879E-26

2.584939E-26

1.292470E-26

6.462349E-27

3.231174E-27

1.615587E-27

8.077936E-28

4.038968E-28

2.019484E-28

1.009742E-28

5.048710E-29

2.524355E-29

1.262177E-29

6.310887E-30

3.155444E-30

1.577722E-30

7.888609E-31

3.944305E-31

1.972152E-31

9.860761E-32

4.930381E-32

2.465190E-32

1.232595E-32

6.162976E-33

3.081488E-33

1.540744E-33

7.703720E-34

3.851860E-34

1.925930E-34

9.629650E-35

4.814825E-35

2.407412E-35

1.203706E-35

6.018531E-36

3.009266E-36

1.504633E-36

7.523164E-37

3.761582E-37

1.880791E-37

9.403955E-38

4.701977E-38

2.350989E-38

1.175494E-38

0.00000

0.00000

0.00000

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1. In algebra, if p > 0 then it's certainly true that 1 + p is different from 1. In the computer this is not so; if p is positive and small 1 + p may evaluate to 1. Devise a strtategy for estimating the p value where the behavior changes. Note that this is not the same question as problem two. The result may depend on the operating system, which compiler you are using and the exact type of processor in the computer. Tell me these things too.

Processor: Intel(R) Core(TM) i7-5500U CPU @ 2.40GHz, 2401 Mhz, 2 Core(s), 4 Logical Processor(s)

Compiler: Windows Command Line

OS Name: Microsoft Windows 10 Home

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! If p is positive and small, 1 + p may evaluate to 1.

! Estimate a strategy for p where the behavior changes.

implicit none

real::p

integer::i

p = 0.0

do i = 1, 40

p = p + 1.0

p = p / 2.0

print\*, p

end do

stop

end

Running this produced the following results:

0.500000

0.750000

0.875000

0.937500

0.968750

0.984375

0.992188

0.996094

0.998047

0.999023

0.999512

0.999756

0.999878

0.999939

0.999969

0.999985

0.999992

0.999996

0.999998

0.999999

1.00000

1.00000

1.00000

1.00000

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