4.8 — Floating point numbers

▲ ALEX

■ AUGUST 11, 2021

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Gcpcę pcępmk cębcobj grgmi qęmobąjm_ rojeęnmoj rejsk `cpqIJ

1 | float fValue; double dValue; 2 | long double ldValue;

V f cleşqdeejim_rdeenmol rejorcp_jqlêju_vqejajsb ceੵrejc_qreniceb cagk_jenj_aceİctclegderfceb cagk_jegqẽgbesfgqefcinqerfceamk ngcpslbcpqr_lberf_rerfcejsk`cpegqejm_rdeenmol rejsk `cpejlbeimejlegircecp=

```
1 int x{5}; // 5 means integer
double y{5.0}; // 5.0 is a floating point literal (no suffix means double type by
default)
float z{5.0f}; // 5.0 is a floating point literal, f suffix means float type
```

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Best practice

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Mmu ęami opb c pęrf gopępyk njc ęnpme p_k IJ

```
1  #include <iostream>
2  int main()
3  {
4    std::cout << 5.0 << '\n';
5    std::cout << 6.7f << '\n';
    std::cout << 9876543.21 <<
'\n';
6    return 0;
}</pre>
```

Sfc epocqs jrqenderf gqepc ck gle jwepgk njc enpme p_k ek _ wepspnpgpc evns IJ

5 6.7 9.87654e+06

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Floating point range

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Floating point precision

Sf ceprecision ende, epim_rdj een mdj rejsk `cpeb cobj cqef mulek_I w*ege I opbe_I reb ge gra*egree_I epc npc qc I reu grf msregid mpk _rgmlejmogFi

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```
1  #include <iostream>
2  int main()
{
4    std::cout << 9.87654321f << '\n';
    std::cout << 987.654321f << '\n';
    std::cout << 987654.321f << '\n';
    std::cout << 987654.321f << '\n';
    std::cout << 9876543.21f << '\n';
    std::cout << 0.0000987654321f <<
'\n';
    return 0;
}</pre>
```

Sfogenpmep_k emsrnsrqIJ

```
9.87654

987.654

987654

9.87654e+006

9.87654e-005
```

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```
3.333333253860474
3.333333333333334
```

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```
#include <iomanip> // for std::setprecision()
#include <iostream>

int main()

float f { 123456789.0f }; // f has 10 significant digits
    std::cout << std::setprecision(9); // to show 9 digits

in f
    std::cout << f << '\n';
    return 0;

}</pre>
```

Ns rns rIJ

```
123456792
```

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Best practice

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Rounding errors make floating point comparisons tricky

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```
#include <iomanip> // for std::setprecision()
#include <iostream>

int main()
{
    double d{0.1};
    std::cout << d << '\n'; // use default cout precision

of 6
    std::cout << std::setprecision(17);
    std::cout << d << '\n';

return 0;
}</pre>
```

Sf gqens rns rqIJ

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```
#include <iomanip> // for std::setprecision()
    #include <iostream>
    int main()
3
4
        std::cout << std::setprecision(17);</pre>
5
        double d1{ 1.0 };
6
        std::cout << d1 << '\n';
        double d2{ 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 }; // should equal
    1.0
9
        std::cout << d2 << '\n';
10
11
        return 0;
    }
```

```
1
0.999999999999999
```

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Key insight

Qmsib decpompoqena aspaif cię ęisk `cpap_ i Nie`caprmpo benp caopcjwłą fogap_ i ęf_nnc i ęctcięu griędkinjc ęisk `cpap igio cą́fita for compc Ĥ pmsib decpompoqa_ i ne ibę ibęb mnę nnc ię jją for ok cał Qmsib decpompoqe po i Nieforecva cnromi ęfną fowybo ąf capsjo tal Nicorpopa i na ibęb magina i na ibęb cap pompoqe po ingresova cnromi ęfną fowybo ąf capsjo tal Nicorpopa i na ibęb cap na ibęb cap pompoqe po ingresova cnromi ęfną fowybo ąf capsjo tal Nicorpopa i na ibęb cap na ibęb c

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NaN and Inf

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```
#include <iostream>
int main()
{
    double zero {0.0};
    double posinf { 5.0 / zero }; // positive infinity
    std::cout << posinf << '\n';

    double neginf { -5.0 / zero }; // negative infinity
    std::cout << neginf << '\n';

    double nan { zero / zero }; // not a number (mathematically invalid)
    std::cout << nan << '\n';
    return 0;
}</pre>
```

@IberfcepcqsjrqesqgleeUgqs_jeRrsbgne \bar{t} ĨĨİemleVgbnuqIJ

```
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-1.#IND
```

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Best practice

@tmob ebogtoggmle` welle_jrmecrfcplectclegobyvnspeamkngcpegsnnmprqegrH

Conclusion

Smępsk k _ pokc ferf ceru merf d eqevnsepf msjbepck ck `cpe_`msregim_rd eenmol reisk `cpq[]

ĩ tết Địm, rgi eạn mgi rế, sk `c po ặc p co bị ạth paặn mọc jiện p cạn pạt c p wạik _ jiệsk `c po fếg ajsb gi eạf moy cạu gri ạt p argmi _ jạa m k n mic l rq H

I tết Địm, rgi eạn mgi rế, sk `c po ạc quốc jạth paặn mọc li grup su l b gi eạc po propo fết c l ạt f c l at f c







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