< STAT-5361 > HW#2-Exercises 3

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September 13, 2018

Keywords: Template; R Markdown; **bookdown**; **knitr**; **Pandoc**

Explain how .Machine*double.xmax*, .*Machine*double.xmin, .Machine*double.eps*, *and*.*Machine*double.neg.eps are defined using the 64-bit double precision floating point arithmetic.

1) Description

(a) Machine() returns information on numeric characteristics of the machine R is running on, such as the largest double or integer and the machine's precision.
(b) .Machine is a variable holding this information.

2) .Machine$double.xmax <- the largest finite floating-point number. Typically, it is equal to (1 - neg.eps) * baseˆmax.exp, but on some machines it is only the second, or perhaps third, largest number, being too small by 1 or 2 units in the last digit of the significand.

```
.Machine$double.xmax
```

```
## [1] 1.797693e+308
```

3) .Machine$double.xmin <- the smallest non-vanishing normalized floating-point power of the radix, i.e., baseˆmin.exp.

```
.Machine$double.xmin
```

```
## [1] 2.225074e-308
```

4) .Machine$double.eps <- the smallest positive floating-point number x such that 1 + x != 1. It equals baseˆulp.digits if either base is 2 or rounding is 0; otherwise, it is (baseˆulp.digits) / 2

```
.Machine$double.eps
```

```
## [1] 2.220446e-16
```

5) .Machine$double.neg.eps <- a small positive floating-point number x such that 1 - x != 1. It equals baseˆneg.ulp.digits if base is 2 or round is 0; otherwise, it is (baseˆneg.ulp.digits) / 2. As neg.ulp.digits is bounded below by -(digits + 3), neg.eps may not be the smallest number that can alter 1 by subtraction.

```
.Machine$double.neg.eps
```

```
## [1] 1.110223e-16
```