Day-14

Cheatsheet

부동소수점 - Cheatsheet

- NaN (mantissa $\neq 0$)

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- $\pm$ infinity

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- Lowest/Largest ($\pm 3.40282 * 10^{+38}$)

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- Minimum (normal) ($\pm 1.17549 * 10^{-38}$)

*	00000001	00000000000000000000000

- Denormal number ($< 2^{-126}$)(minimum: $1.4 * 10^{-45}$)

*	00000000	**********

- ± 0

*	00000000	00000000000000000000000

	E4M3	E5M2	half
Exponent	4 [0*-14] (no inf)	5-bit [0*-30]	
Bias	7	15	
Mantissa	4-bit	2-bit	10-bit
Largest (±)	$1.75 * 2^8$ 448	$1.75 * 2^{15}$ 57, 344	2^{16} 65, 536
Smallest (±)	2^{-6} 0.015625	2^{-14} 0.00006	
Smallest (denormal*)	2^{-9} 0.001953125	2^{-16} $1.5258 * 10^{-5}$	2^{-24} $6.0 \cdot 10^{-8}$
Epsilon	2^{-4} 0.0625	2^{-2} 0.25	2^{-10} 0.00098

	bfloat16	float	double
Exponent	8-bit [0*-254]		11-bit [0*-2046]
Bias	127		1023
Mantissa	7-bit	23-bit	52-bit
Largest (±)	2^{128} $3.4 \cdot 10^{38}$		2^{1024} $1.8 \cdot 10^{308}$
Smallest (±)	2^{-126} $1.2 \cdot 10^{-38}$		2^{-1022} $2.2 \cdot 10^{-308}$
Smallest (denormal*)	/	2^{-149} $1.4 \cdot 10^{-45}$	2^{-1074} $4.9 \cdot 10^{-324}$
Epsilon	2^{-7} 0.0078	2^{-23} $1.2 \cdot 10^{-7}$	2^{-52} $2.2 \cdot 10^{-16}$

부동소수점 - Limits

```
#include<limits>
// T: float or double

std::numeric_limits<T>::max(); // 최대값
std::numeric_limits<T>::lowest(); // 최솟값 (C++11)
```

```
std::numeric_limits<T>::min(); // 가장 작은 값
std::numeric_limits<T>::denorm_min(); // 가장 작은(비정규) 값
std::numeric_limits<T>::epsilon(); // 엡실론 값
std::numeric_limits<T>::infinity(); // infinity
std::numeric_limits<T>::quiet_NaN(); // NaN(Not a Number)
```

부동 소수점 - 유용한 함수들

```
#include<cmath> // C++11
using namespace std;
// T : float or double

bool isnan(T value);     // value가 NaN인지 확인
bool isinf(T value);     // value가 +-infinity인지 확인
bool isfinite(T value);  // value가 NaN or +-infinity가 아닌지 확

bool isnormal(T value);  // value가 정규수인지 확인

T ldexp(T x, p);         // 지수 shift x*2^p
int ilogb(T value);      // value의 지수를 출력
```