3x3的大方块，表面涂成了红色。切成27块后， 随便取一块，扔到桌子上，有五面是白色。问最后一面是红色的概率。

如果只是单纯的bayes，那是6/7。然而这里最tricky的部分在于，这个 方块是被扔到桌子上然后观察的。红色的那一面被压在底下的概率也要考虑。所以，对于6个只有一面是红色的方块，扔到桌上恰好红色一面压在底下的概率是1/6。所以再根据贝叶斯公式(6/27*1/6)*(6/27*1/6 + 1/27) = 1/2

一个数列，要对它排序。已知每个元素与正确位置不超过k个位置，问能用什么方法？如何并行？

插入排序 O(kn)，堆排序(大小为k+1的堆)，O(nlogk)

并行：分成几个子数组排序（也满足不超过k位置），再合并

X=掷骰子100次的和，Y=掷硬币600次head的次数，问Pr(X>Y)

用 CLT，全部当成正态分布来算

街上有很多人，认为他们的身高是iid的。我现在随机取一个人，身高为X。然后我不停的sample身高直到找到一个比X高的人，假设我看了N个人；问N的期望

几何分布，令 p(X) = P(x_i > X)，几何分布的期望是 1/p(X)，即对 X，需要看 1/p(X) 个人，所以 N 等于 1/p(x) 对 x 积分。可以发现 N 的值与 X 具体是什么分布无关，假设 X 是均匀分布，可以算出 N = inf.

进程内存图
Segmentation Fault 由谁在什么情况下产生
是不是所有 memory access 都要检查是否合法 / kernel 什么时候检查 memory access
找n个元素前k小，堆 O(nlogk), partition O(n)
设计一个结构，可以contain, insert, remove, removeLastInserted

double list + hash map

- If you had a file with 1 billion 32 bit integers, how would you find a missing integer?（Missing就是0到2^32的数位没有在file内）

1. O(n) running time, O(n) space就要存所有的数到一个set里面，然后看哪个不在
2. O(n^2) running time, O(1) space就要brute force。0到2^32一个一个看在不在文件里
3. Compromise method（这是面馆告诉我的）O(n) running time, O(n) space。有点像第一个method但是你先看1-1，000，000，000有没有缺的数位。有的话再看missing是不是在从1-500，000，000等等。基本上就是divide&conquer。

TCP/UDP
malloc 怎么实现
stack 和 heap 的区别（问的是内存空间的stack和heap）
Is there a case when you would store a local variable on the heap?

不确定variable大小的(大小会动态变化)

program counter的具体步骤
问C++里面的memory management，stack和heap的区别，heap怎么manage的
问C++里的virtual keyword有啥用，让你举例子，问call virtual method大约是怎么实现的
问C++里的unique pointer和shared pointer是什么，怎么实现的
描述一个data structure可以支持add 1 element和pop一个random element
现在add的每个element有个weight，同样要支持pop一个random element propotional to its weight
pip 和 redirect区别，exit用法

https://my.oschina.net/badboy2/blog/478953

'|' pipe 将前一个标准输出作为标准输入传递给后一个脚本，不能处理标准错误，'>' / '<' redirect 将标准输出写入文件/将文件作为标准输入，可以redirect error: '2>'

return 从程序中返回，exit结束脚本执行

roll a 6-faced fair dice 100 times, and have a claim that the sum of all rolls is 400, do you trust that claim, why?
I have 8 coins, you have 9 coins, we rolls all of them the same time, what is the probability that you have more Heads that I do?

都有8个coins: P(x=y) = p, P(x>y) = P(x<y)

多的那个人(y)再投一次，最后结果比另一个人大的概率是 P(x=y)*0.5 + P(x<y)，小于等于他的概率是 P(x=y)*0.5 + P(x>y), 两者相等。

所以是1/2.

1000 people stand in a circle with label from 1 to 1000, first person has a sword and kills the 2nd person before passing the sword to the 3rd person and repeat the process until one survives, tell me the position of the survival.

The significance of the powers of 2 is that these can halve without a remainder. Hence if the number of players is a power of 2 the survivor will be the person who starts the game.

Now consider: when we have a game with something other than a power of 2 players as we kill people, the number of players will necessarily reduce to be a power of two. At that point the survivor will be the person holding the sword. Effectively the first player in a game with 2^n players.

In our example starting with 100 players - we need to kill 36 of them to get down to a power of 2 (64). Since we kill every other person starting at player 2 the last person we need to die is player 72, they will be killed by player 71 and the first person in the effective power of 2 game, who will win is player 73.

(It's worth noting that this process of reducing to a power of 2 will always be completed in the first round regardless of the number of players, but why?)

Consider X players, let Y be the highest power of 2 that is less than or equal to Y
The winning player is 2 * (X - Y) + 1

you have N size array with all elements as 0, you have an operation that given range [a,b], you flip all the state during that range (0->1 or 1->0), but you are doing those operations millions of times, how do you get the final state of this array. and give an algorithm to do that.

segment tree + lazy update

5个南瓜，两两一组称重，给出了10个重量，求每个南瓜的重量

10 个重量排序，5个南瓜，假设重量由小到大，可以先求出5个重量和，又知道最小两个的和与最大两个的和，求出中间的和，知道第二小的组合，第二大的组合，求出全部的。

25匹马赛马的智力题

五个一组比，五个第一名比，第一名组第二、三，第二名组第二，第三名组第一比。

X, Y 都是高斯随机变量 即服从正态分布。求 X > 3Y 的概率

P(X>3Y) = P(X-3Y>0), Z=X-3Y 是均值为 0 的正态，关于 0 对称。

两个机器人碰面问题。就是如何设定好程序，让两个在一维坐标轴上相隔一段距离的机器人能碰面，彼此无法沟通，但是可以侦测地面上是否有足迹（无法判断谁的）

我说的办法就是让两个机器人匀速朝一个方向走，第一个碰到足迹的加速追赶。

you have a one-way road, N cars on the road, each have different speed, once the front car has lower speed you are struct at that block, what is the expected number of those blocks?

A car will eventually (remember that the road is very long) be in the same group as the one before it if that car is slower from the start or is eventually slower because it has to decelerate for some car ahead. Ultimately, a car will be the first car of a cluster iff none of the cars before it has a slower initial speed. Hence the number of clusters is the number of "new records" or peaks in a sequence of random variables. As a matter of fact, the distribution V does not matter (as long as it is continuous) and one may work simply with a permutation of speeds. Let $F(n,k)$ be the set of permutations of $\{1,\dots,n\}$ with k peaks and $f(n,k)=|F(n,k)|$. The elements of $F(n+1,k)$ that start with 1 can be bijected with $F(n,k-1)$ by dropping the leading 1 and decreasing each number by one. The elements of $F(n+1,k)$ that not start with 1 can be mapped to $F(n,k)$ by dropping the one and decreasing each number by one, but this time each element of $F(n,k)$ is obtained n times (depending on the position of the 1). We conclude

第n+1个是最小值 f(n,k-1)

第n+1个不是最小值 nf(n,k)

$$f(n+1,k)=f(n,k-1)+nf(n,k).$$

Actually, we are interested in $E_n=\frac{1}{n!}\sum_k kf(n,k)$, the expected number of peaks in a random permutation. Summing k times (1) over k produces

$$\sum_k kf(n+1,k)=\sum_k(k-1)f(n,k-1)+\sum_k f(n,k-1)+n\sum_k kf(n,k)$$

$$(n+1)!E_{n+1}=n!E_n+\sum_k f(n,k)+n!nE_n.$$

Using $\sum_k f(n,k)=n!$, we find

$$E_{n+1}=E_n+\frac{1}{n+1}$$

and with $E_1=1$ we see thath E_n is the nth harmonic number.

$$\sum_{n=1}^{k}\frac{1}{n}=\ln k+\gamma+\varepsilon_k\leq(\ln k)+1$$

where γ is the Euler–Mascheroni constant and $\varepsilon_k\sim\frac{1}{2k}$ which approaches 0 as k goes to infinity. Leonhard Euler proved both this and also the more striking fact that the sum which includes only the reciprocals of primes also diverges, i.e.

如何知道stack是往上是往下，怎么判断heap往哪个方向生长

stack: func_a 声明变量a, 调用 func_b，并把 a 的地址传给 func_b, func_b 声明变量 b，比较 a,b 地址，因为 a 先入栈，所以如果 a 的地址大，说明栈向下生长。

heap: 用sbrk指针判断？？通过判断栈来确定。

经典的老鼠试毒药问题，100个酒瓶，最少多少只老鼠能试出来哪瓶有毒

ceil(log_2(100))，如果能测两轮，老鼠有第一轮死，第二轮死，两轮都没死三种状态，ceil(log_3(100)) 只

有16瓶水1瓶有毒，用多少只小白鼠能测出14瓶无毒的水?

将16瓶药水用二进制XXXX表示，取3只小白鼠来测，测出的状态为XXX，那么毒在XXX0或XXX1中，剩下14瓶无毒。

说下vector和list的区别，各种操作的时间复杂度

endianess大小端，如何判断

大端字节序：高字节存放在低地址，低字节存放在高低址

小端字节序：低字节存放在高低址，高字节存放在低地址

int a = 0x1, char* p = &a, if *p == 0 小端

也可以用union

设计一个链表，在插入和删除操作中，不加锁也能保证操作原子性

用CAS实现。CAS是英文单词**CompareAndSwap**的缩写，中文意思是：比较并替换。CAS需要有3个操作数：内存地址V，旧的预期值A，即将要更新的目标值B。CAS指令执行时，当且仅当内存地址V的值与预期值A相等时，将内存地址V的值修改为B，否则就什么都不做。整个比较并替换的操作是一个原子操作。最初的CAS有ABA问题。

amortized analysis of vector push_back, what if 1.5x rather than 2x, what if add 1000 to capacity rather than 2x

m/(m-1)

https://cs.stackexchange.com/questions/9380/why-is-push-back-in-c-vectors-constant-amortized

inline function
volatile key word
假设有X个A星人和Y个B星人坐一圆桌，每个A星人只和A星人自己握手，B星人只和B星人自己握手，而且握手只会和自己左/右的人握手。问任意两个人之间的握手概率

数排列组合个数，2/(X+Y-1) * (X(X-1))/((X+Y)(X+Y-1)) + 2/(X+Y-1) * (Y(Y-1))/((X+Y)(X+Y-1))

详细问TCP UDP，问DNS，为什么DNS不用TCP实现

DNS: Domain Name System

TCP慢

vector link 内存上的区别
function的stack怎么堆的
线程如何共享资源

进程间通信IPC需要特别的方法，线程间可以直接读写进程数据段（如全局变量）来进行通信。每个线程有自己的堆栈和程序计数器为其执行上下文。

mutex & semaphore 底层实现
Inter process communication 以及各种细节，linux系统间进程如何通信
Leetcode 的 Buy and Sell Stock I and III
Single number I III