

## 1 Brain teasers

### 1.1 Pirates distributing gold

- 5 Pirates distribute 100 gold coins. Senior pirate proposes and all vote, and plan gets approved if 50 % vote ok else senior pirate gets killed and process restarts with 1 fewer pirate.
- 1 pirate → not interesting
- 2 pirates → New pirate #2 gets all the gold, since he will vote for himself and get just enough (50%) vote
- 3 pirates → pirate #1 will vote with new pirate # 3 since otherwise case above and pirate #1 gets nothing, So let pirate #1=1 and let pirate #3=99 and let pirate #2=0

- 4 pirates → pirate #2 wants to avoid above so pirate #2 votes with new pirate #4. So pirate #4=99, pirate #2=1, pirate #1=pirate #3=0
- 5 pirates → pirate #1,#3 wants to avoid above so pirate #2,#3 votes with new pirate #5. So pirate #5=98, pirate #1=pirate #3=1, pirate #2=pirate #4=0

### 1.2 Tiger changing to sheep

- 100 tigers + 1 sheep. Tiger → Sheep. How many sheep left?
- 1 tiger + 1 sheep → 2 sheep - ok as last tiger won't be eaten
- 2 tigers + 1 sheep → 1' Tiger + 2 sheep but last tiger runs risk of being eaten so tiger not moving
- 3 tigers + 1 sheep → 2 tigers + 2 sheep → stays like this else the last tiger will think he might get eaten
- 4 tigers + 1 sheep → 3 tigers + 2 sheep → might be eaten so no

- even number of tigers: no, odd: yes
  - 100 even so : no
- ### 1.3 4 people crossing a river
- A,B,C,D cross a river on one bridge, max 2 people at one time, one torch. A(10mins),B(5),C(2),D(1). Quickest way to all cross and how long does it take ?
  - send 2 slowest A,B together but not on first crossing else one has to come back (slow)
  - C,D(2) → D(1)→A,B(10)→
  - C(2)→C,D(2)
  - =2+1+10+2+2=17
  - note quicker than:
  - A,D(10)→D(1)→B,D(5)
  - →D(1)→C,D(2)
  - =10+2+5+1+2=20
- ### 1.4 Card game, 52 cards, 2R, 2B, 1R+1B.
- 52 cards. 2B → Dealer, 2R → You, 2R → Ø. 100 to you if you

win (more or same number of cards), 0 otherwise. How much to pay for the game?

- Always 1R+1B discarded, so always equal number of R,B left, so always ties, so you always win, so pay 100

### 1.5 Burning rope

- classic - burn rope at both ends

### 1.6 Find defective ball

- 12 balls, 1 is lighter or heavier (not sure). You have a balance. Find which one in 3 measurements
- separate in 3 each time: (1,2,3,4),(5,6,7,8),(9,10,11,12)
- compare (1,2,3,4) vs (5,6,7,8).
- Same → (9,10,11,12), else (1,2,3,4) (L) or (5,6,7,8) (H)
- Same: left with (9,10,11,12) H or L with (5,6,7,8) normal
- (9,10) vs (8,11)

## 2 Maths