Machine Learning Foundations Homework #1

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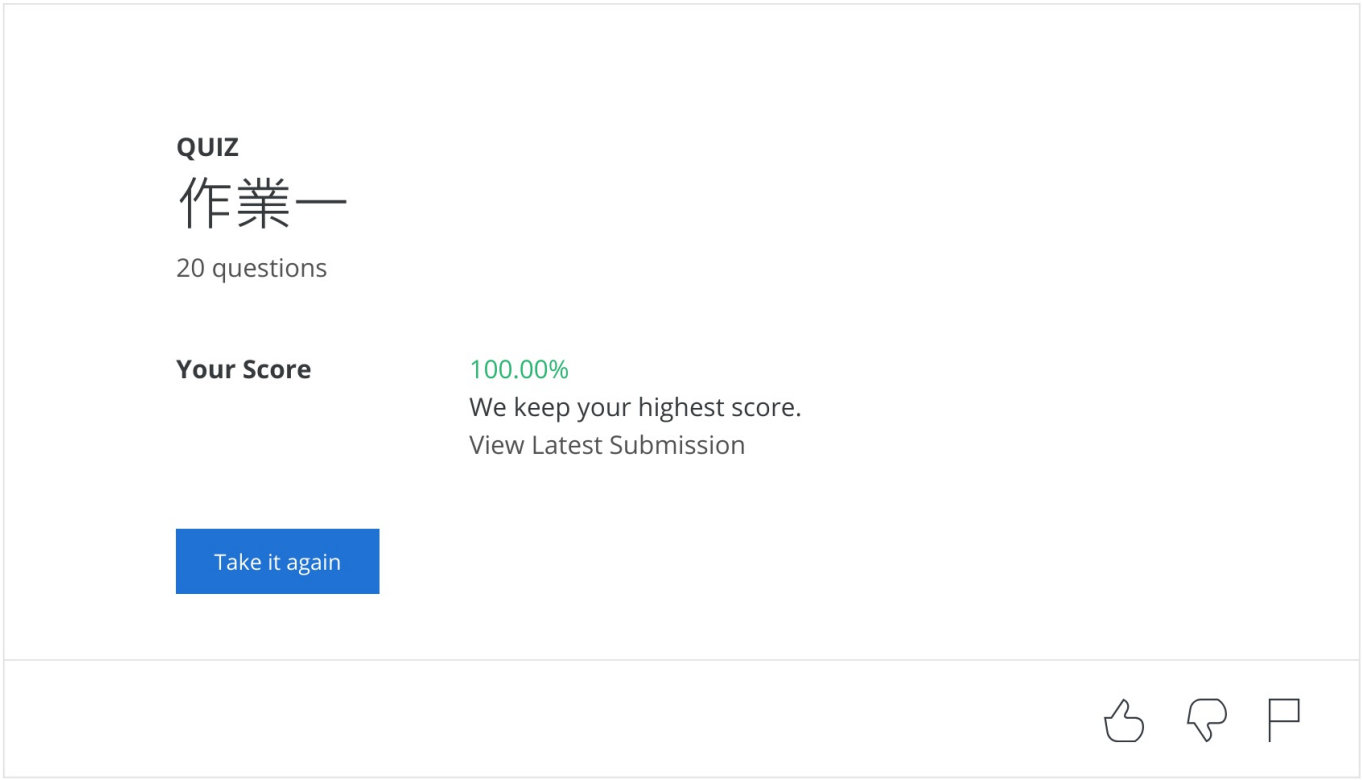


problem 2

題目可以轉換成 N+1 ~ N+L 有多少個偶數:

$$\begin{aligned}&\frac{1}{L} * (\text{N+1 ~ N+L 有多少個偶數})\\ =&\frac{1}{L} * ((\text{1 ~ N+L 有多少個偶數}) - (\text{1 ~ N 有多少個偶數}))\\ =&\frac{1}{L} * (\frac{\lfloor N+L \rfloor}{2} - \frac{\lfloor N \rfloor}{2})\end{aligned}$$

problem 3

$$\begin{aligned}\mathbb{E}_f\Big\{E_{OTS}(\mathcal{A}(\mathcal{D}), f)\Big\} &= \frac{1}{2^L}\sum_{i=1}^{2^L}\frac{1}{L}\sum_{l=1}^{L}[\![g(X_{N+l}) \neq f_i(X_{N+l})]\!]\\ &= \frac{1}{2^L}\frac{1}{L}\sum_{l=1}^{L}\sum_{i=1}^{2^L}[\![g(X_{N+l}) \neq f_i(X_{N+l})]\!]\\ &= \frac{1}{2^L}\frac{1}{L}\sum_{l=1}^{L}2^{L-1} \quad (\because \text{對和錯各佔一半})\\ &= \frac{1}{2} \Rightarrow \text{常數，和演算法無關}\end{aligned}$$

problem 4

μ = 0.8

> what is the probability of v ≤ 0.1?
>
> $C_{10}^{0} * 0.2^{10} + C_{10}^{1} * 0.8 * 0.2^{9} = 0.2^{10} + 10 * 0.8 * 0.2^{9} = 4.2 * 10^{-6}$

> what is the probability of v ≥ 0.9?
>
> $C_{10}^{0} * 0.8^{10} + C_{10}^{1} * 0.2 * 0.8^{9} = 0.8^{10} + 10 * 0.2 * 0.8^{9} = 0.376$

problem 5

題目可以轉換成拿到只有 A 和 D 的機率，每個骰子的機率都一樣，所以是 $(\frac{2}{4})^5 = \frac{1}{32}$

problem 6

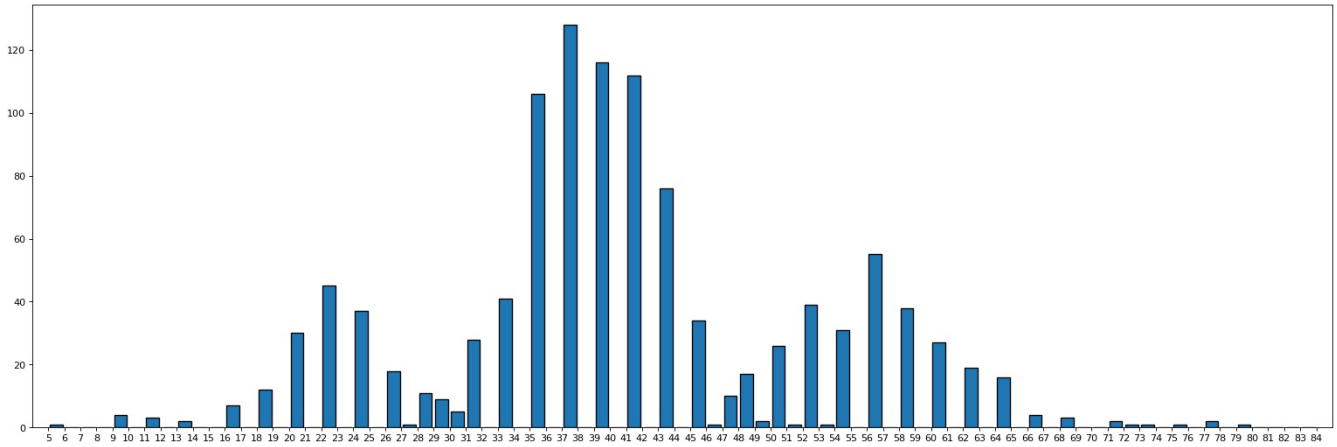
number	1	2	3	4	5	6
green	AD	BD	AD	BC	AC	BC

總共有 AC, BC, AD, BD 四種組合，然後考慮到 ABCD 各個重複計算 $(\frac{2}{4})^5 * 4 - (\frac{1}{4})^5 * 4 = \frac{31}{256}$

比較之後可以觀察到單一數字都是綠色的機率都是 $\frac{1}{32}$，但是它們在一起計算會互相影響，不是獨立事件

problem 7

- average number of updates: 40.476



Bonus