1227. Airplane Seat Assignment Probability

Tom · Follow
Oct 20, 2020

Problem Link: https://leetcode.com/problems/airplane-seat-assignment-probability/

We can calculate the probability P(n will seat on his/her own seat). To simplify the problem, assume that i-th customer is assigned to i-th seat

> *P(n will seat on his/her seat) = P(1 not seat on n-th seat, 2 not seat on n-th seat, ….. (n-1) not seat on n-th seat)*

For 1st customer,

1. if 1 seats on 1st seat, then 2 will pick 2nd seat, 3 will pick third one and everyone will seat on assigned seat (P = 1/n)
2. if 1 seats on 2nd seat, then 2 faces the same situation as 1. 2 needs to randomly pick a seat from (n-1) seats
3. if 1 seats on 3rd seat, then 2 has to pick 2nd and 3 will face the same situation as 1, randomly picking a seat from (n-2) seats

Now we can clearly see the patterns here. Assume that f(n) is the probability that we are looking for, when n > 2,

$$f(n) = \frac{1}{n} + f(n-1)\times\frac{1}{n} + f(n-2)\times\frac{1}{n} + \ldots f(2)\times\frac{1}{n}$$

when n ≤ 2,

1. f(1) = 1

2. f(2) = 0.5

And we can prove that f(n) == f(n-1) when n > 2

$$
\begin{aligned}
f(n) &= \frac{1}{n} + f(n-1) \times \frac{1}{n} + f(n-2) \times \frac{1}{n} + \ldots f(2) \times \frac{1}{n} \\
&= \frac{1}{n}(1 + f(2) + f(3) + \ldots + f(n-1)) \\
f(n-1) &= \frac{1}{n-1} + f(n-2) \times \frac{1}{n-1} + f(n-2) \times \frac{1}{n-1} + \ldots f(2) \times \frac{1}{n-1} \\
&= \frac{1}{n-1}(1 + f(2) + f(3) + \ldots + f(n-2)) \\
f(n) &= \frac{f(n-1)(n-1) \; + \; f(n-1)}{n} = f(n-1)
\end{aligned}
$$

So when n≥2 , f(n) is always 0.5

Leetcode Math Probability

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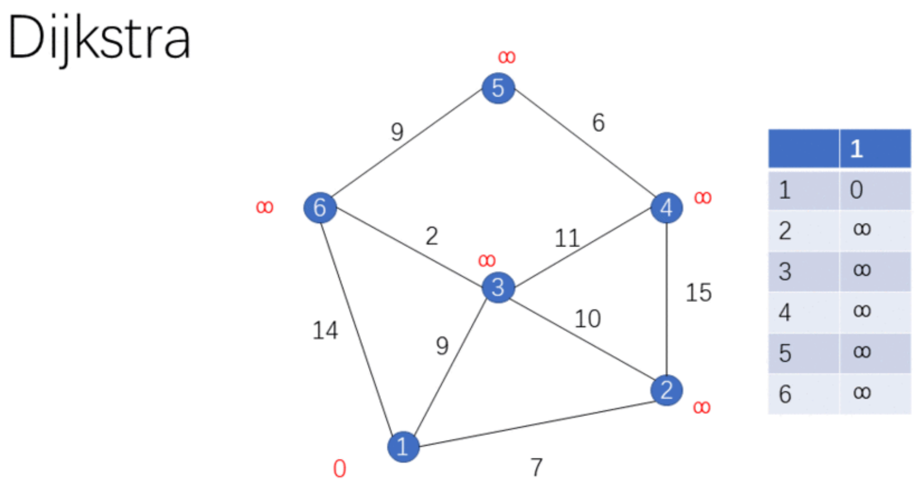

	1
1	0
2	∞
3	∞
4	∞
5	∞
6	∞

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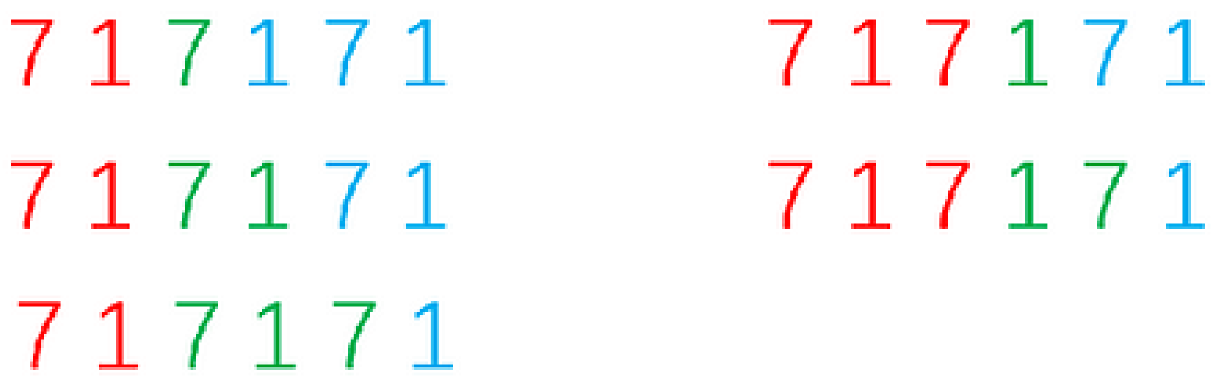

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Problem link: https://leetcode.com/problems/minimum-difficulty-of-a-job-schedule/description/

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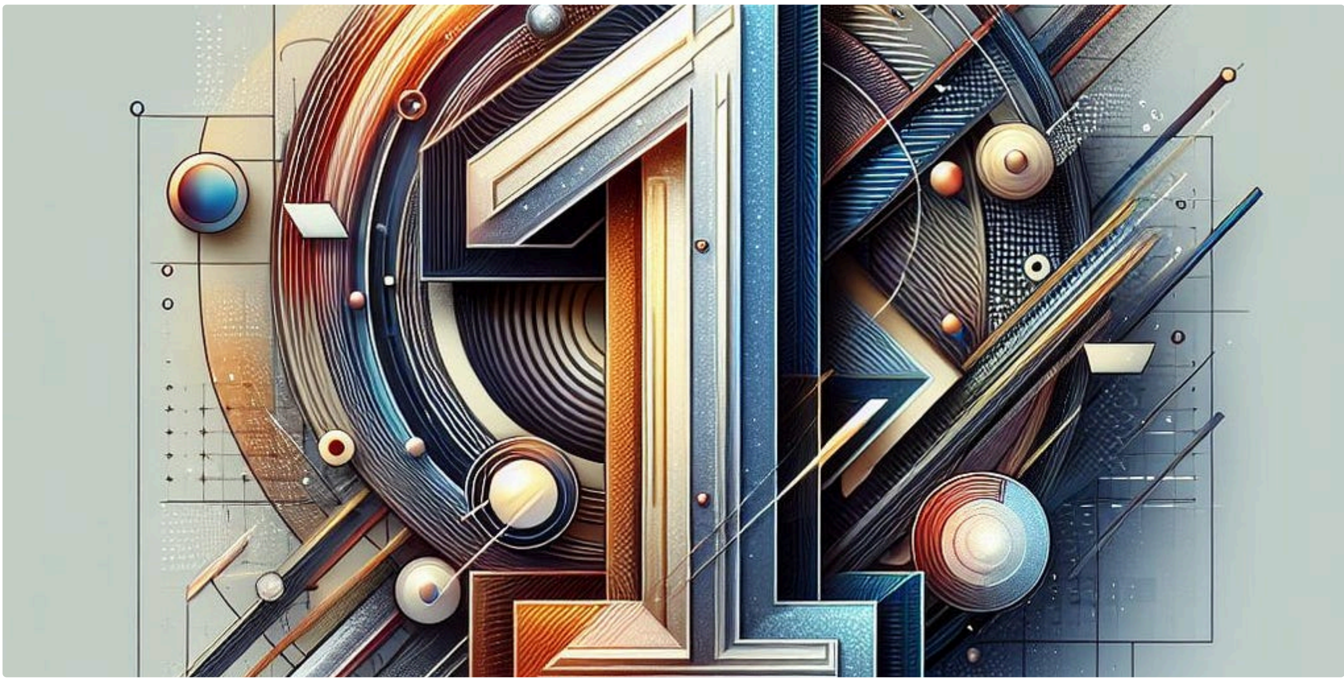

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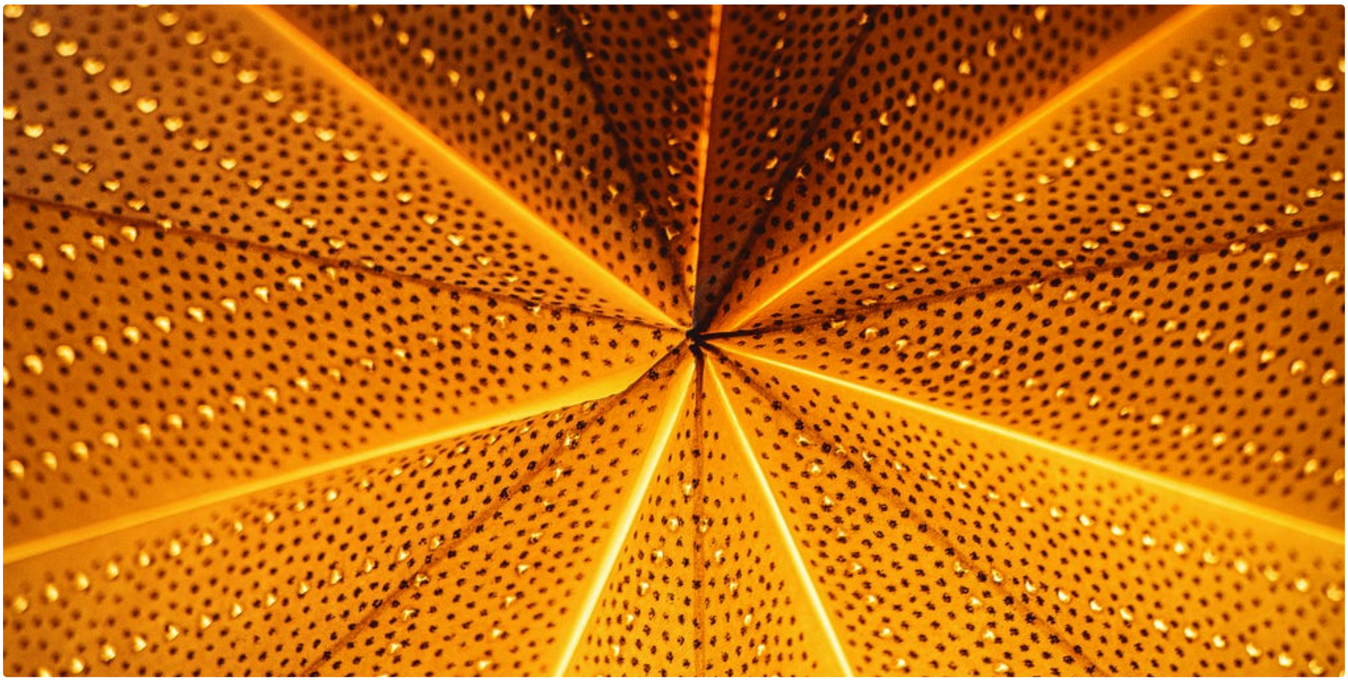

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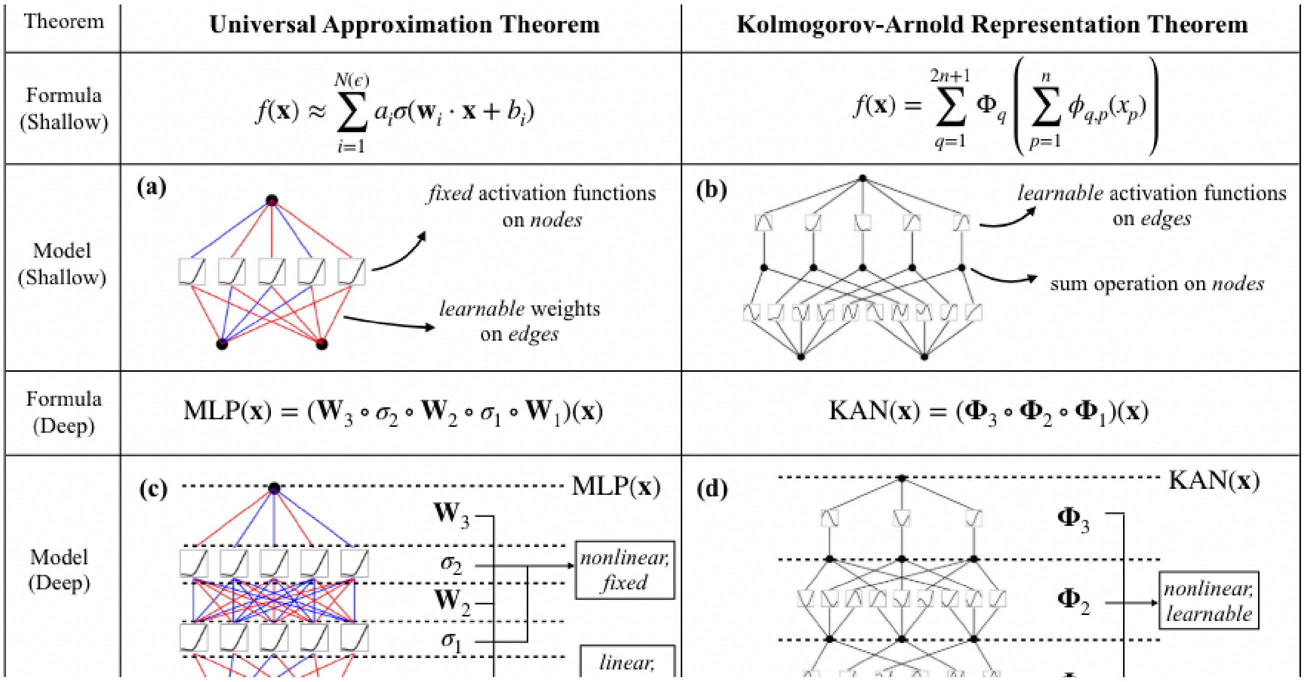

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Setup	θ is unknown and fixed	θ is a random variable
What do we want?	$\hat{\theta}$ is the best estimate of θ (but fixed)	$p(\theta\|x, y)$ posterior distribution dictated by the data
What do we need?	Build a model using the data (x, y) *to* determine $\hat{\theta}$	Using the data determine $p(\theta)$ – prior probability
How we do it?	OLS: $\hat{\theta} = \frac{Cov(y,x_i)}{Var(x_i)}$ ML: $\mathcal{L}(x, \theta)$ likelihood function	$p(\theta\|x, y) \propto L(x, y\|\theta) * p(\theta)$ Find $p(\theta)$
Inference	$H_0: \theta = 0$ and $H_a: \theta \neq 0$ p-value is the probability that $\theta > \theta$	$p(\theta > \theta_c\|x, y)$ read from posterior probability


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