

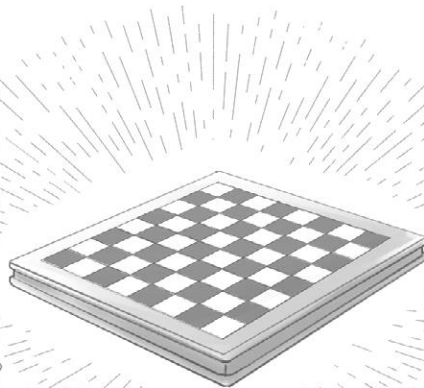
# 18 棋盘里的智慧



gǔ yìn dù yǒu yī wèi jiào xī tǎ de dà chén tā cōngmíng guò rén fā míng le yī zhǒng tè shū  
古印度有一位叫锡塔的大臣，他聪明过人，发明了一种特殊  
de qí guó wáng rú huò zhì bǎo bǎi wán bú yàn jué dìng zhòng shǎng xī tǎ biàn bǎ tā zhào dào  
的棋，国王如获至宝，百玩不厌，决定重赏锡塔，便把他召到  
diàn qián kuā xià hǎi kǒu nǐ yào shén me shǎng cì zhèn dōu yí dìng dā ying nǐ xī tǎ tǐng zhí  
殿前夸下海口：“你要什么赏赐，朕都一定答应你。”锡塔挺直  
le yāo huí dá bì xià wēi chén zhǐ yào yí diǎn er mài zi bú guò zhè xiē mài zi yào fàng  
了腰回答：“陛下，微臣只要一点儿麦子，不过，这些麦子要放  
zài wēi chén fā míng de qí pán de liù shí sì gè gé zǐ lǐ dì yī gé yī lì dì èr gé liǎng lì  
在微臣发明的棋盘的六十四个格子里。第一格一粒，第二格两粒，  
dì sān gé sì lì dì sì gé bā lì dì wǔ gé shí liù lì dì liù gé sān shí èr lì  
第三格四粒，第四格八粒，第五格十六粒，第六格三十二粒……  
měi gé yào bǐ qián yī gé duō fàng yí bèi mài zi zhí dào bǎ liù shí sì gè qí gé dōu tián mǎn  
每格要比前一格多放一倍麦子，直到把六十四个棋格都填满。”

## Wisdom in the chessboard

In ancient India, there was a minister named Sita. He was very clever, and he invented a special kind of chess, the king loved it very much and decided to reward Sita handsomely. He summoned Sita to his presence and praised: "Whatever reward you want, I will definitely fulfil your request." Sita straightened his back and replied: "Your Majesty, I only want a little wheat, but these wheat should be placed in the sixty-four grids of the chessboard I invented. One grain in the first square, two grains in the second square, four grains in the third square, eight grains in the fourth square, sixteen grains in the fifth square, thirty-two grains in the sixth square ... fill each square double the amount of wheat of the previous square until all sixty-four squares are filled."



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guówángtīng le hā hā dà xiào , rèn wéi xī tǎ jīn tí chū zhè yàng yí gè “ jiǎn dān ” de yāo  
国王听了哈哈大笑，认为锡塔仅提出这样一个“简单”的要  
qiú , zhēn shì gè róng yì mǎn zú de rén 。 liáng cāng lǐ de mài zi duō de shì ! guó wáng kāng kǎi dì  
求，真是个人容易满足的人。粮仓里的麦子多的是！国王慷慨地  
chuán lìng liáng shí dà chén jí kè ná chū yì xiē mài zi 。  
传令粮食大臣即刻拿出一些麦子。

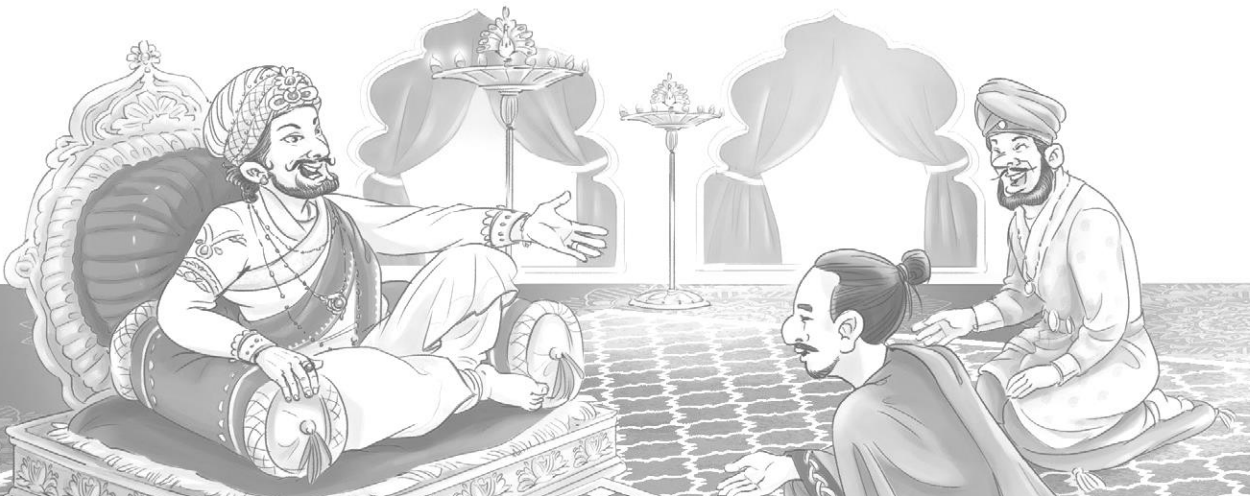
zài chǎng de měi yí wèi dà chén dōu rèn wéi yí xiǎo dài mài zi jiù néng tián mǎn qí pán shàng de liù  
在场的每一位大臣都认为一小袋麦子就能填满棋盘上的六  
shí sì gè qí gé , yǒu de rén shèn zhì rěn bú zhù cháo xiào xī tǎ 。 mài zi qǔ lái hòu , liáng shí dà  
十四个棋格，有的人甚至忍不住嘲笑锡塔。麦子取来后，粮食大  
chén bù gǎn dài màn , kāi shǐ jì suàn , yí lì , liǎng lì , sì lì , bā lì ..... qián mian jǐ gè  
臣不敢怠慢，开始计算，一粒、两粒、四粒、八粒……前面几个  
qí gé de mài zi hěn kuài jiù bèi jì suàn chū lái 。 dàn shì màn màn dì , suǒ yòng de mài zi kāi shǐ míng  
棋格的麦子很快就被计算出来。但是慢慢地，所用的麦子开始明  
xiǎn duō le qǐ lái , sān shí èr lì , liù shí sì lì , yī bǎi èr shí bā lì , èr bǎi wǔ shí liù  
显多了起来，三十二粒、六十四粒、一百二十八粒、二百五十六  
lì , wǔ bǎi yī shí èr lì , yì qiān líng èr shí sì lì .....  
粒、五百一十二粒、一千零二十四粒……

The king laughed when he heard this, thinking that Sita only made such a "simple" request, and was really a person who can be satisfied easily. There is a lot of wheat in the granary! The king generously ordered the food minister to take out some wheat immediately.

Every minister present thought that a small sack of wheat could fill the sixty-four squares on the chessboard, and some even couldn't help but laugh at Sita. After fetching the wheat, the Minister of Food did not delay but began to count, one grain, two grains, four grains, eight grains..., the wheat of the first few squares were quickly counted. But slowly, the amount of wheat began to increase significantly, thirty-two grains, sixty-four grains, one hundred and twenty-eight grains, two hundred and fifty-six grains, five hundred and twelve grains, one thousand and twenty grains four grains...

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suí zhe liáng shì dà chén diǎn suàn dào qí pán de sān fēn zhī yī bān yùn mài zi de gōng jù què  
随着粮食大臣点算到棋盘的三分之一，搬运麦子的工具却  
yǐ jīng yóu bù dai huàn chéng běn jǐ yòu yóu běn jǐ huàn chéng luó kuāng jiē xià lái gāng gāng hái zài  
已经由布袋换成畚箕，又由畚箕换成箩筐。接下来，刚刚还在  
diàn lǐ qǔ xiào xī tǎ de dà chén dōu biàn dé ān jìng yīn wéi mài zi lì shǔ xùn sù zēng zhǎng xū  
殿里取笑锡塔的大臣都变得安静，因为麦子粒数迅速增长，需  
yào dòng yòng mǎ chē bān yùn le  
要动用马车搬运了。

liáng shì dà chén tōng xiāo chè yè bù duàn jì suàn pín pín dū cù suí cóng jiāng yì chē yòu yì chē mài  
粮食大臣通宵彻夜不断计算，频频督促随从将一车又一车麦  
zi bān yùn jìn diàn tā xīn lǐ wàn fēn jiāo jí jī hū bēng kuì guó wáng kǒng pà dé shǎng cì yì  
子搬运进殿。他心里万分焦急，几乎崩溃：国王恐怕得赏赐亿  
wàn liàng chē de mài zi gěi xī tǎ  
万辆车的麦子给锡塔。

kàn dào mài zi shān yí zuò duī de bǐ yí zuò gāo jī hū lián chéng le yí dào shān mài guó  
看到麦子山一座堆得比一座高，几乎连成了一道山脉。国  
wáng hé dà chén dōu jīng hài bù yǐ xīn zhōng yǒu shù jiù suàn péi shàng guó kù de suǒ yǒu mài zi  
王和大臣都惊骇不已，心中有数：就算赔上国库的所有麦子，  
yě tián bù mǎn zhè ge qí pán ā  
也填不满这个棋盘啊！

As the food minister counted to one-third of the chessboard, the tool for transporting wheat had to be replaced from a cloth bag to a dustpan, and from a dustpan to a basket. Next, the ministers in the palace who were making fun of Sita earlier became quiet, because the number of wheat grains increased rapidly and they needed to be transported by horse-drawn carts.

The food minister kept counting all night long, and kept on urging his followers to carry cart after cart of wheat into the palace. He was so anxious that he almost **collapsed**: the king might have to reward Sita with millions of carts of wheat.

The mountains of wheat were piled up one after another, almost forming a **mountain range**. The king and the ministers were horrified, knowing that even if they paid all the wheat in the treasury, they would not be able to fill the chessboard!

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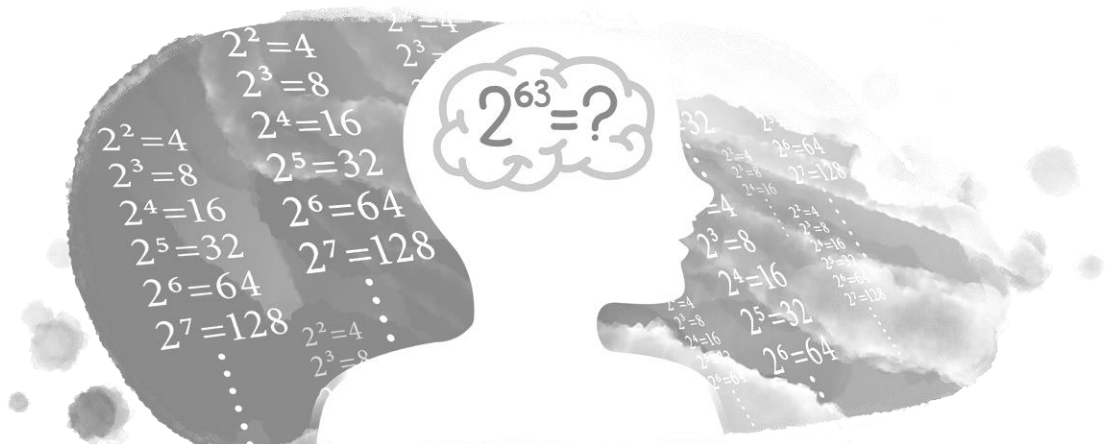
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xī tǎ tí chū de zhè ge yào qiú kàn sì jiǎn dān qí shí shì yùn cáng le shù xué de jǐ  
 锡塔提出的这个要求，看似简单，其实是蕴藏了数学的几  
 hé bèi zēng yuán lǐ qí wēi miào zhī chù zài yú zhǐ yào yí gè shù zì dà yú huò děng yú èr nà me  
 何倍增原理，其微妙之处在于只要一个数字大于或等于二，那么  
 àn jǐ hé jī shù zēng jiā shí qí bèi zēng de sù dù jiù huì shí fēn jīng rén  
 按几何级数增加时，其倍增的速度就会十分惊人。

xī tǎ de qí pán yí gòng yǒu liù shí sì gè gé zǐ dào le dì liù shí sì gè gé shí xū  
 锡塔的棋盘一共有六十四格子，到了第六十四格时，需  
 yào shǎng cì gěi tā de mài zǐ zài dāng shí yǐ wú fǎ jì suàn chū lái gèng hé kuàng zhè zhǐ shì dì liù  
 要赏赐给他的麦子在当时已无法计算出来，更何况这只是第六  
 shí sì gé de zhì liàng rú guǒ bǎ měi gè gé zǐ de mài zǐ quán dōu jiā qǐ lái nà gāi shì yí gè  
 十四格的质量，如果把每个格子的麦子全都加起来，那该是一个  
 duō me páng dà de shù mù a  
 多么庞大的数目啊！

qū qū yí gè èr jū rán zài chéng shì lǐ biàn huà chéng kě yǐ qīng fù guó jiā de yí  
 区区一个“二”，居然在程式里变化成可以倾覆国家的一  
 gè shù zì ne  
 个数字呢！



Sita's request seems simple, but **hidden** in it is the geometric multiplication principle of mathematics. The subtlety is that as long as the number is greater than or equal to two, when it increases according to the geometric progression, its multiplying effect is **astounding**.....

There are sixty-four squares in Sita's chessboard. When the sixty-fourth square is reached, the wheat that needs to be rewarded to him could not even be calculated at that time. Bearing in mind that this is only the amount for the sixty-fourth square, the total amount of wheat in all the squares amounts to be an enormous number.

A mere number "two" can be programmatically turned into a number so large that could sink a country!