

VIC SKEPTICS

Logic and Maths Puzzles 97 August 2020

1. The epic TV miniseries *Throneplay* has been aired. It consists of four episodes, with the titles being (not necessarily in order of screening) *Encounter*, *Altercation*, *Intrigue* and *Battle*. Each episode features a different one of the four main characters (Lord Claude, Lady Sadie, Sir Cumstance and Lester the Jester). From the following clues, work out the title and chief protagonist of each episode.

(i) The four episodes are *Battle*, the one about Lester the Jester's pilgrimage, Episode 1 and *Altercation*.

(ii) Lord Claude's big moment comes in one of the two middle episodes.

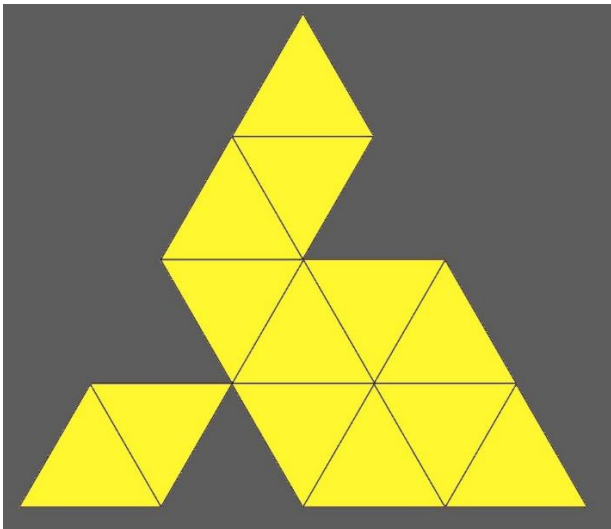
(iii) Although Lady Sadie's character is introduced late in the episode entitled *Encounter*, her life story is the theme of the next episode.

(iv) Lester dies before Episode 4 begins; Episode 4 is not *Altercation*

	<i>Encounter</i>	<i>Altercation</i>	<i>Intrigue</i>	<i>Battle</i>	Lord Claude	Lady Sadie	Sir Cumstance	Lester the Jester
Episode 1								
Episode 2								
Episode 3								
Episode 4								
Lord Claude								
Lady Sadie								
Sir Cumstance								
Lester the Jester								

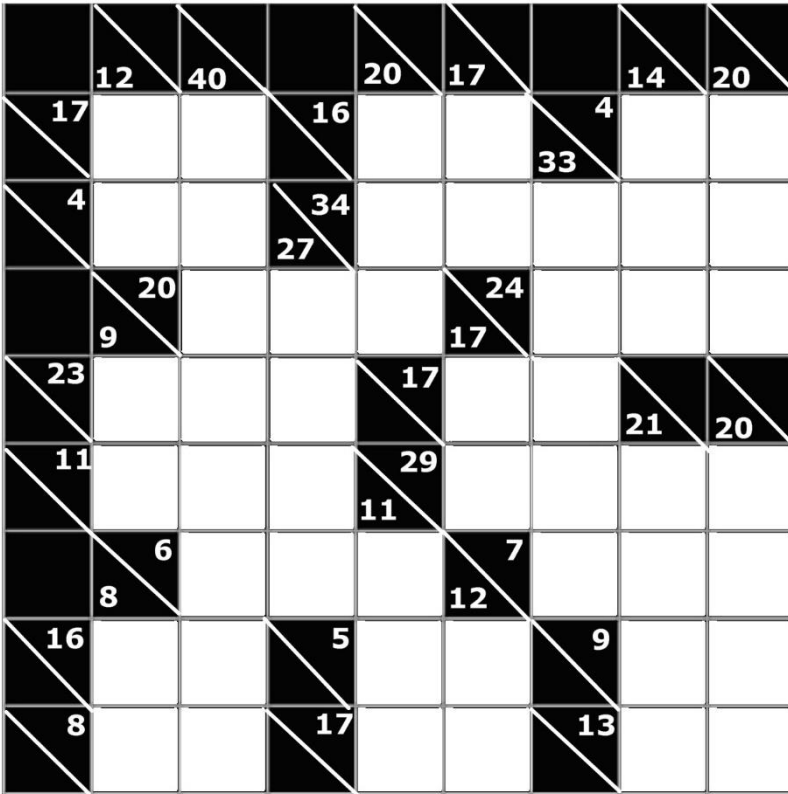
2.

How Many Triangles?



What is the total number of triangles in this figure?

5.



This is a Cross Sum puzzle. It is solved by inserting one digit from 1 to 9 into each white square so that each horizontal or vertical string of digits adds up to a given target number.

For example 

means "find two digits that add up to 7" and this



means "find three digits that add up to 9"

The digits you use must agree horizontally and vertically, just like the letters in a crossword puzzle

You can only use each digit once in any string. For example, the target number 16 can be made up from 9 and 7, NOT 8 and 8.

6.



Figure It Out

In one throw of two dice, what is the chance of throwing: (a) a double? (b) a score of 2? (c) A score of 9?

7.

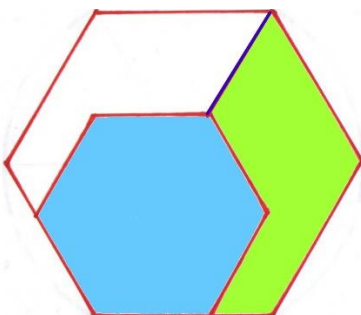


Figure It Out

A porter leads five guests to their individual hotel rooms. Unfortunately the keys are unlabeled and the porter has mixed up the order. Using trial and error, what is the **maximum** number of attempts the porter must make before he opens all the doors?

8.

AREAS OF INTEREST



The diagram on the right is based on two regular hexagons. Each side of the smaller hexagon is two thirds the length of each side of the larger hexagon.

Which one of the following is true?

- The blue and green regions have the same area
- The green area is 1.2 times larger than the blue area
- The blue area is 1.6 times larger than the green area
- It is not possible to calculate which of the two shaded areas is larger with the information provided.

9.

Sequences

(a) Continue this pattern with the next two numbers; **1, 2, 3, 5, __, __**

(b) Continue this pattern with the next two letters; **M, V, E, M, J, S, __, __**

10. One room in an Australian Natural History museum is dominated by four display cases, each of which features a different extinct animal and a different "living fossil" plant (one of which is a horsetail).

Four attendants (Baker, Collins, Dean and Foyle) have each been given the job of guarding one of the cases and for providing commentary about it to museum visitors.

Match each display case with its featured animal and plant, and the person responsible for it.



Front
entrance

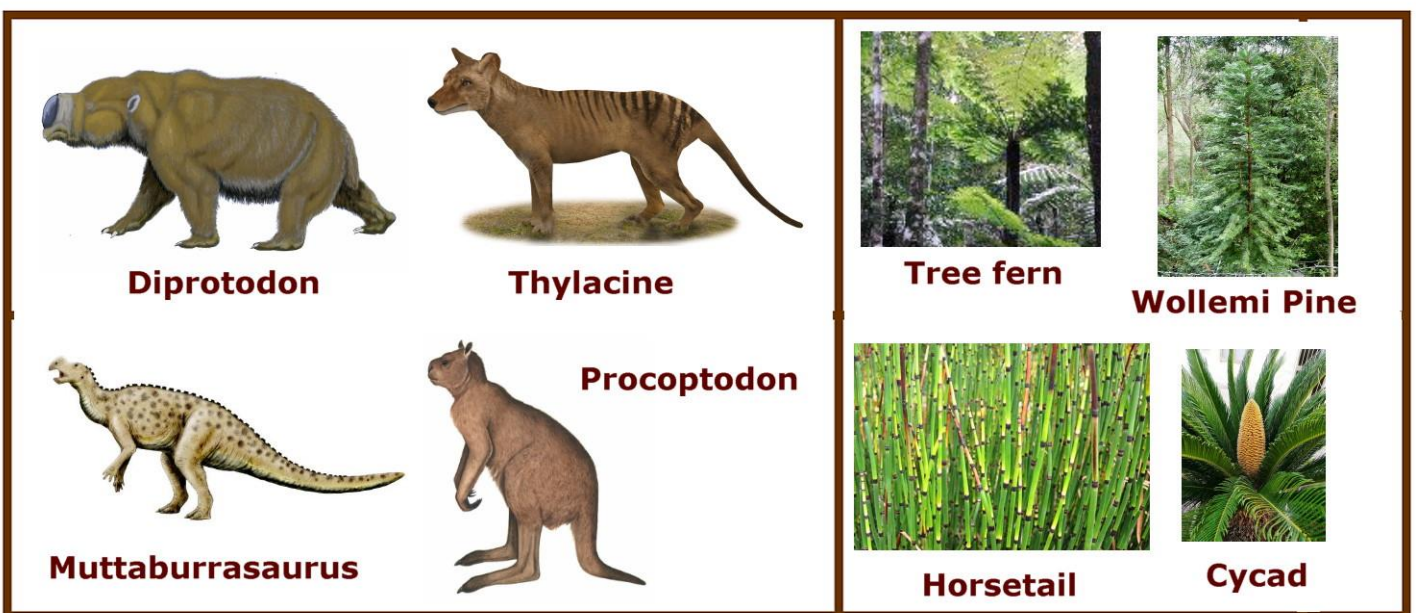
(i) Dean's case is in the opposite corner to that containing the Diprotodon.

(ii) The case containing Cycads is side by side with that featuring the Thylacine

(iii) The Muttaborrasaurus's case is behind that of the Wollemi Pine.

(iv) Case 3 (Which isn't Collins's) doesn't contain the Procoptodon.

(v) The four attendants are Baker, the one looking after the Thylacine, and the two looking after the tree fern and the Wollemi Pine.



Answers:

The answers are repeated together with worked solutions on the next page.

1. Episode 1 is *Intrigue* featuring Sir Cumstance; Episode 2 is *Altercation* featuring Lord Claude; Episode 3 is *Encounter* featuring Lester the Jester; and Episode 4 is *Battle* featuring Lady Sadie.

2. 15 triangles

3. (2nd) Queen of Diamonds (4th) Jack of Diamonds (6th) King of Spades

4. First considered: Cancer research \$500, donated
Second considered: Children's Hospital, \$2,000, donated
Third considered: Heart research, \$1,500, donated
Fourth considered: Refugee welfare, \$1,000, not donated.

5.

	12	40		20	17		14	20
17	9	8	16	7	9	4	1	3
4	3	1	34	4	8	7	6	9
	20	4	8	9	24	9	7	8
23	8	6	9	17	9	8		
11	1	3	7	11	8	5	7	9
	6	2	3	1	12	4	1	2
16	7	9	5	2	3	9	5	4
8	1	7	17	8	9	13	8	5

6. (a) 1 in 6 or 5 to 1 ; (b) 1 in 36 or 35 to 1; (c) 1 in 9 or 8 to 1

7. 15 attempts

8. c. The blue area is larger than the green area

9. a. 8, 13 b. U, N (Uranus, Neptune)

10. Baker looks after case 1, containing the Muttaborrasaurus and the cycads.
Dean looks after case 2, containing the Thylacine and the horsetails.
Foyle looks after case 3, containing the Diprotodon and the Woolemi Pine.
Collins looks after case 4, containing the Procoptodon and the tree fern.

ANSWERS WITH SOLUTIONS:

1.

The character who features in Episode 1 is not Lester - Clue (i)
 or Lord Claude – Clue (ii)
 or Lady Sadie - Clue (iii)
 So it must be Sir Cumstance

	Encounter	Altercation	Intrigue	Battle	Lord Claude	Lady Sadie	Sir Cumstance	Lester the Jester
Episode 1		X		X	X	X	✓	X
Episode 2							X	
Episode 3							X	
Episode 4	X				X		X	
Lord Claude								
Lady Sadie	X							
Sir Cumstance								
Lester the Jester		X		X				

The character who features in episode 4

Is not Lord Claude – Clue (ii)
 Or Lester – Clue (iv)
 So it must be Lady Sadie

	Encounter	Altercation	Intrigue	Battle	Lord Claude	Lady Sadie	Sir Cumstance	Lester the Jester
Episode 1		X		X	X	X	✓	X
Episode 2						X	X	
Episode 3						X	X	
Episode 4	X				X	✓	X	X
Lord Claude								
Lady Sadie	X							
Sir Cumstance								
Lester the Jester		X		X				

Since we're told that Lady Sadie features in the next episode after *Encounter*, *Encounter* is Episode 3.

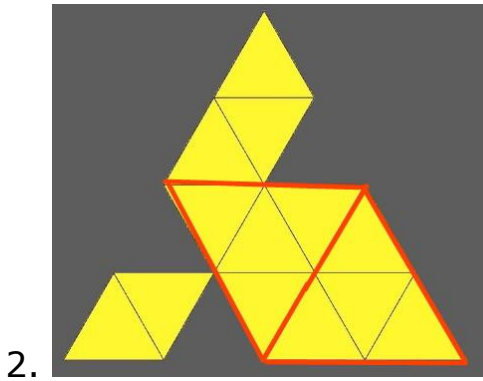
That means Episode 1 can only be *Intrigue*, featuring Sir Cumstance.


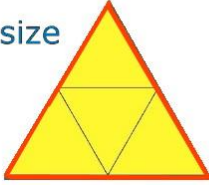
That in turn only leaves *Encounter* as Episode 3 featuring Lester the Jester.

By elimination, Lord Claude features in Episode 2

Episode 4 is not *Altercation* – Clue (iv)
 So it's *Battle*. *Altercation* is Episode 2

	Encounter	Altercation	Intrigue	Battle	Lord Claude	Lady Sadie	Sir Cumstance	Lester the Jester
Episode 1	X	X	✓	X	X	X	✓	X
Episode 2	X	✓	X	X	✓	X	X	X
Episode 3	✓	X	X	X	X	X	X	✓
Episode 4	X	X	X	✓	X	✓	X	X
Lord Claude	X	✓	X	X				
Lady Sadie	X	X	X	✓				
Sir Cumstance	X	X	✓	X				
Lester the Jester	✓	X	X	X				



There are 13 triangles of this size 
and 2 of this size 

3. Because of the sharp contrast and lack of shadow defining the edges of the cards, it may be worth magnifying the image. It can then clearly be seen that the Queen of Hearts overlies the King of Spades, 8 of Spades and Jack of Diamonds. It is the 7th and last card dealt. The King of Spades overlies the 8 of Spades which in turn overlies the Jack of Diamonds. Apart from the Queen of Hearts, no other card overlies the King of Spades, which is therefore the 6th card dealt. The Ace of clubs is partly covered by the Jack of Diamonds but itself partly covers the Queen of Diamonds. Close examination reveals that it is the Queen of Diamonds which overlies the 2 of Diamonds, and not the other way around. Therefore the order in which the cards were dealt is:
2 of Diamonds; Queen of Diamonds; Ace of Clubs; Jack of Diamonds; 8 of Spades; King of Spades; Queen of Hearts.

4
Zoe's considered donations had to be four of \$500, \$1,000, \$1,500, \$2,000 and \$2,500.
Clue (i) One of Zoe's contributions was for \$1,500. Although it turned out to be her final contribution, at that stage she hadn't yet seen the refugee welfare site.
Clue (ii) Of the four different levels of support Zoe thought appropriate to each of the four charities, she included the highest and the lowest in her actual donations.
The \$1,500 donation couldn't have been the highest or the lowest. We know she didn't donate to the refugee site; so she did make three donations (Highest, lowest, \$1,500) of which the \$1,500 was third. The refugee site was the fourth considered.

	HEART	CANCER	CHILDREN	REFUGEES	\$ (Lowest)	\$ 1,500	\$ other	\$ (Highest)	Donated	Didn't donate
First				X		X	X		✓	X
Second				X		X	X		✓	X
Third				X	X	✓	X	X	✓	X
Fourth	X	X	X	✓	X	X	✓	X	X	✓
Donated	✓	✓	✓	X	✓	✓	X	✓		
Didn't donate	X	X	X	✓	X	X	✓	X		
\$ (Lowest)				X						
\$ 1,500				X						
\$ other	X	X	X	✓						
\$ (Highest)				X						

(Continued next page)

Clue (iii) Zoe's considered donation to the Children's Hospital was \$1,500 greater than her considered donation to the cancer research fund.

Possibilities: [Cancer \$500, Children \$2,000; Cancer \$1,000, Children \$2,500] Neither of those is the \$1,500 donation, and we know both were actually made,

So "Cancer" is the lowest, "Children" is the highest and "Heart" is the \$1,500 donation hence the third donation.

	HEART	CANCER	CHILDREN	REFUGEES	\$ (Lowest)	\$ 1,500	\$ other	\$ (Highest)	Donated	Didn't donate
First	X			X		X	X		✓	X
Second	X			X		X	X		✓	X
Third	✓	X	X	X	X	✓	X	X	✓	X
Fourth	X	X	X	✓	X	X	✓	X	X	✓
Donated	✓	✓	✓	X	✓	✓	X	✓		
Didn't donate	X	X	X	✓	X	X	✓	X		
\$ (Lowest)	X	✓	X	X						
\$ 1,500	✓	X	X	X						
\$ other	X	X	X	✓						
\$ (Highest)	X	X	✓	X						

Clue (iv) Zoe's considered donation to the first website she looked at was \$500 less than that of the fourth.

The first donation was not the highest, therefore it was the lowest. It was the "Cancer" donation. The "Children" donation was the second made.

Possibilities for the "Cancer" donation are:

\$500, with the considered donation to the fourth website being \$1,000;

OR \$1,000 with the considered donation to the fourth "refugees" website being \$1,500; however, as a \$1,500 donation was made to the "Heart" website, the "Cancer" donation was \$500, the mooted donation to "refugees" \$1,000 and the "Children's" donation $$(500 + 1,500) = $2,000$

	HEART	CANCER	CHILDREN	REFUGEES	\$ (Lowest) 500	\$ 1,500	\$ other 1,000	\$ (Highest) 2000	Donated	Didn't donate
First	X	✓	X	X	✓	X	X	X	✓	X
Second	X	X	✓	X	X	X	X	✓	✓	X
Third	✓	X	X	X	X	✓	X	X	✓	X
Fourth	X	X	X	✓	X	X	✓	X	X	✓
Donated	✓	✓	✓	X	✓	✓	X	✓		
Didn't donate	X	X	X	✓	X	X	✓	X		
\$ (Lowest) 500	X	✓	X	X						
\$ 1,500	✓	X	X	X						
\$ other 1000	X	X	X	✓						
\$ (Highest) 2000	X	X	✓	X						

5. See above

6. The table shows 36 equally likely outcomes generating **scores** of 2 to 12

		Dice 1					
		1	2	3	4	5	6
Dice 2	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

(a) There are six outcomes which are a result of both dice making the same contribution to the score. The probability of throwing any double is therefore 6 in 36 or 1 in 6.

(b) A score of 2 may only be achieved when both dice contribute 1. The probability is 1 in 36.

(c) A score of 9 may be achieved four different ways. The probability of throwing a 9 is therefore 4 in 36 or 1 in 9.

7. If the porter opens the first room on his fifth attempt he is left with four rooms and four keys.
 If he opens the second room on his fourth attempt he is left with three rooms and three keys.
 If he opens the third room on his third attempt he is left with two rooms and two keys.
 If he opens the fourth room on his second attempt he is left one room and one key.

8. Areas of Interest: The area of the smaller hexagon (blue area) is $\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$ or $\frac{8}{18}$ or 44.4% that of the larger hexagon. The green area is thus half of $\frac{5}{9}$ the total area of the larger hexagon or $\frac{5}{18}$ or 27.8%. Another method is to divide the figure up into 18 equal triangles and to count how many triangles in each area.

9. (a)

1	2	3	5	8	13	21
		1 + 2 = 3	2 + 3 = 5	3 + 5 = 8	5 + 8 = 13	8 + 13 = 21

This is The Fibonacci Sequence

See https://en.wikipedia.org/wiki/Fibonacci_number

(b) Requires some lateral thinking; logical, if not arithmetical.

10. Clue (v): *The four attendants are Baker, the one looking after the Thylacine, and the two looking after the tree fern and the Wollemi Pine.*

and Clue (ii) *The case containing cycads is side by side with that featuring the Thylacine*

The Thylacine is not in the same case as the cycads, the tree fern or the Wollemi Pine.

- The Thylacine must therefore be sharing its case with the only remaining plant option, the horsetails.

- Baker is the attendant for the cycads.
- The horsetails and cycads are side-by-side, (i.e. in positions 1 & 2 or in 3 & 4)
- Therefore the tree fern and the Wollemi Pine are also in side-by-side positions.
- Clue (iii) *The Muttaborrasaurus's case is behind that of the Wollemi Pine.* The tree fern and the Wollemi Pine share positions 3 & 4, the horsetails and cycads share positions 1 & 2.
- The Muttaborrasaurus and the Thylacine share positions 1 & 2. Baker must be responsible for both the cycads and the Muttaborrasaurus

1
 Horsetails=Thylacine
 Cycads = Baker =
 Muttaborrasaurus

2
 Horsetails=Thylacine
 Cycads = Baker =
 Muttaborrasaurus

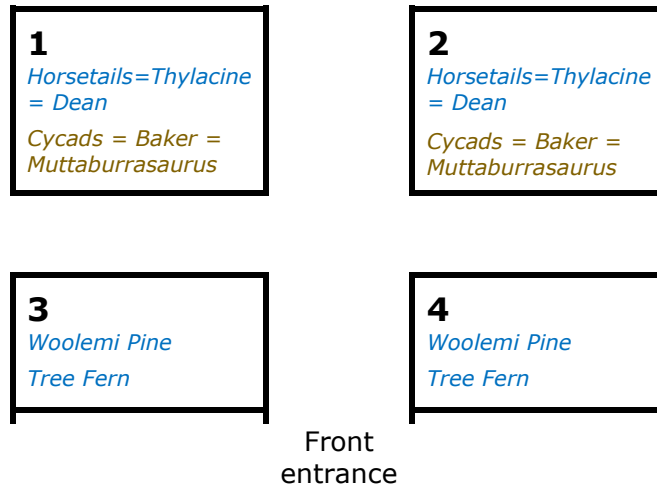
3
 Woolemi Pine
 Tree Fern

4
 Woolemi Pine
 Tree Fern

Front
 entrance

Clue (i) *Dean's case is in the opposite corner to that containing the Diprotodon.*

As the Thylacine and the Muttaborrasaurus share the back row (1 & 2), the Diprotodon must be in the front row (either 3 or 4). Therefore Dean is in the back row. He must be the attendant for both the Thylacine and the horsetails.



By elimination, the attendants sharing positions 3 & 4 are Collins and Foyle.

Clue (iv): *Case 3 (Which isn't Collins's) doesn't contain the Procoptodon.*

- Collins is the attendant for Case 4 and Foyle is the attendant for case 3.
- The Procoptodon is in case 4, hence the Diprotodon is in Case 3.
- Dean looks after case 2 containing the Thylacine and Horsetails.
- Baker looks after case 1, containing the Muttaborrasaurus and the cycads.

Clue (iii) *The Muttaborrasaurus's case is behind that of the Woollemi Pine.*

- The Woollemi Pine is in case 3. The tree fern is in case 4