Reading Complex Waits

BuckwheatECG Duckwheat
Adapted from the work of

Introduction

In mahjong, it is notoriously difficult to quickly and accurately determine what tiles a closed full flush hand is waiting on. There is an apparent lack of a detailed, comprehensive guide for how to read such waits in English. This article attempts to fill this gap.

In terms of application, full flushes are rare in Japanese Modern mahjong, occurring in around 1% of hands, with closed, complex shapes diminishingly rare compared to even that. Despite this, some players find complex shapes interesting and worth studying on their own. Players of other variants of mahjong, such as Sanma and SBR, may find themselves applying this knowledge more often, as these games give full flushes a more enticing effort-reward ratio.

Most of the content is translated and adapted from "多面听分析" by 纯全三色对对和 (<u>https://www.bilibili.com/read/readlist/rl119817</u>), with some changes to sectioning and formatting to aid comprehension, minor edits for accuracy, and some additions for basic knowledge the original author omitted.

Preliminary Material

Basic Wait Patterns

There are five basic wait patterns in mahjong:

Name	Description	Example	Waits On
Open wait	Two consecutive tiles, waiting for another tile on either end.	8 8 8 8	()
Closed Wait	Two tiles with a difference of 2, waiting for a tile in between.	三萬	回邁
Edge Wait	12 waiting for 3, or 89 waiting for 7.		
Pair Wait	Two identical pairs, waiting for a third copy of either.	DD	₽ ₽
Single Wait	With four complete sets, waiting to match the last tile.		

Suji

Extending Waits

Wait patterns can be **extended** if they are adjacent to completed sets in specific ways. Such extensions are the basic building blocks of complex waits.

Shape	Waits	Extension	Extended Shape	Extended Waits
三萬四萬	二萬-伍萬	三四 + 伍六七萬	三四五六七萬	二
8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	8 8 8 8	$ \begin{array}{c} & \otimes & \otimes & \otimes \\ & \otimes & \otimes & \otimes \\ & \otimes & \otimes & \otimes$	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	 (a) - (b) + (b)
H H	E E			
◎ ◎ ◎ ◎ ▲ 入 ◎ ◎ ◎ ◎ ◎ ▲ ▲	◎◎ ◎◎ 【萬	 ○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○	● ● ● ● ○ 六 七 八 八 ● ● ● ● ● ■ 萬 萬 萬	 ● ● ● ● ▲ ●
		$\begin{bmatrix} \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \end{bmatrix} + \begin{bmatrix} \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \end{bmatrix} \begin{bmatrix} \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \end{bmatrix} \begin{bmatrix} \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \\ \mathbf{B} & \mathbf{B} \end{bmatrix}$		

A completed sequence extends any wait along a *suji* if one end of the sequence overlaps the wait.

*These are usually interpreted as simple open waits. The examples show how they can be considered extensions instead.

A **single wait** can not only be extended by a sequence whose end overlaps the wait as seen above, but also along a *suji* by **a sequence adjacent to the wait**, in which case the extended wait is also a **single wait**. In addition, a **single wait** can also be extended to outside its *suji* by **any triplet 1 or 2 numbers away** from it.

Shape	Waits	Extension	Extended Shape	Extended Waits
HHH HHH				
Ĺä	Ĺ	萬+三三萬	「三三三	「萬」二萬
8 8 8 8 8	8 8 8 8	$ \begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ $	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8

The above shows **single waits can be extended in more ways** than other wait patterns. This means when counting waits of partial hands as an intermediate step to counting waits of the whole hand, **it is important which waits can be considered single waits**.

Finally, a **pair wait** can be extended along a *suji* by **two adjacent identical sequences.** This occurs far less often than any of the above and is included for completeness.

Shape	Waits	Extension	Extended Shape	Extended Waits
H H H H H H				光 HH-HH

The Method

From the above, a systematic method can be devised to read the waits of complex shapes:

- Separate one completed set (usually a sequence) from the hand.
 - Sometimes, it helps to separate a pair instead.
- Compare the resulting partial hand with a list of memorized **core shapes.**
 - If a memorized shape matches, proceed to the next step.
 - o If no memorized shape matches, separate another completed set, and try again.
- List the waits of the core shape. Note which waits can be considered single waits.
- Add the separated sets back to the hand. If this extends any existing waits, list the new waits.
 - Repeat until all separated sets are added.
 - Sets can be added in any order.

There are two caveats to this method:

- Some memorization is required. The speed and accuracy of the method depends on how many • and how accurately core shapes are memorized. While most core shapes can be broken down using the method itself to obtain even simpler shapes, it's probably best to memorize at least a few frequent core shapes to speed up the process.
- When separating completed sets from the hand, care must be taken to avoid missing other possible ways those tiles could be used. Much of this article focuses on how to avoid such misses. In some cases, a hand must be subdivided more than once, each by separating different sets, to be counted thoroughly.

Shortcuts exist to speed up this method after it is learned. The most obvious is to memorize more core shapes. Other shortcuts include recognizing when multiple completed sets can be separated without missing those tiles' other uses.

Core Shapes

Single waits are listed in parentheses, to emphasize their importance.

Basic Core Shapes

These shapes occur frequently and should be memorized.

- - **H H** extends the **H** single wait to **H**.

- 🚊 🖫 🌋 🛣 👼 🗇 waits on 👼 🚊 🌋 -
- **11111111111** waits on (**1**-**1**-**1**).
 - □ IIIIIIIIII extends the I single wait twice to II-₩.
 - This example shows where one sequence can extend a wait along a *suji*, two consecutive sequences extend it twice along that *suji*.
- - $\circ \quad \textcircled{\begin{tabular}{c} \bullet \bullet \\ \bullet \bullet \bullet \\ \bullet \bullet \bullet \\ \bullet \bullet \bullet \\ \bullet \\$
 - \circ $\left[\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & & \\ & & & \\ & & & \\ & &$
 - This example shows extensions of single waits are not always single waits.
- 「蓋言靈鑑益基 waits on (黃)-優-益.
 「蓋三靈鑑益 a single wait twice to 優-金.

Independent Core Shapes (7 tiles)

These shapes cannot be simply reduced to any shape seen above by separating a sequence. While it is still possible to apply the counting method to analyze them, it's less effort overall to memorize them as their own core shape.

- - Separating $\begin{bmatrix} I \\ I \\ I \end{bmatrix}$ shows the $\begin{bmatrix} III \\ III \\ III \end{bmatrix}$ wait.
 - Separating I B B shows the III wait.
- $(\overset{\otimes}{\otimes})^{\circ}_{\circ} \overset{\otimes}{\otimes}^{\circ}_{\circ} \overset{\circ}{\otimes}^{\circ}_{\circ} \overset{\circ}{\otimes} \overset{\circ}{\circ} \overset{\circ}{\circ} \overset{\circ}{\otimes} \overset{\circ}{\otimes} \overset{\circ}{\otimes} \overset{\circ}{\otimes} \overset{\circ}{\circ} \overset$
 - Separating $\overset{\textcircled{\mbox{\tiny (a)}}}{\overset{\textcircled{\mbox{\tiny (b)}}}{\overset{\textcircled{\mbox{\tiny (b)}}}{\overset{\end{array}{\mbox{\tiny (b)}}}{\overset{\textcircled{\mbox{\tiny (b)}}}{\overset{\end{array}{\mbox{\tiny (b)}}$
 - $\circ \quad \text{Separating} \overset{\circ}{\circledast} \overset{\otimes}{\circledast} \overset{\otimes}{\circledast} \text{shows the} \overset{\circ}{\circledast} \overset{\circ}{\circledast} \text{wait.}$
- - Separating 🚡 🚡 shows the 🚡 wait.
 - Separating 蓋蓋 shows the 室 幽 wait.
- - $\circ \quad \text{Separating} \ \fbox{\textcircled{1}} \ \fbox{\textcircled{1}} \ \r{\r{1}} \ shows \ the \ \r{\r{1}} \ \r{\r{1}}} \ \r{\r{1}} \ \r{\r{1}} \ \r{\r{1}} \$

- - Separating [⊕] [⊕] [⊕] [⊕] [⊕] [⊕] [⊕] waits.
 - By **symmetry**, the shape also waits on **P**-
- 三言言國意意。waits on 言 (圖) 伍.
 - Separating 蘆蘆蘆 shows the II 僅 waits.
 - By symmetry, the shape also waits on $\begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \end{bmatrix}$.

The following shapes include a concealed four-of-a-kind, and thus occur far less often. Memorizing them is optional.

- \circ $\left[\frac{1}{2} \right] \left[\frac{1}{2} \right] \frac{1}{2} = 0$ extends the $\left[\frac{1}{2} \right] = 0$ single wait to $\left[\frac{1}{2} \right]$. • **H** extends the **H** single wait to **H**. $\overset{\otimes}{\otimes} \overset{\otimes}{\otimes} \overset{\otimes$
- $\boxed{\boxed{\underline{x}} = \underbrace{\overline{z}}_{\underline{z}} = \underbrace{\overline{z}}_{$
 - \overline{\version} \overline \version \overline{\version} \overline{\version} \overline{\
 - 薏薏薏 extends the 薏 single wait to 富 靈

Derived Core Shapes (7 tiles)

These shapes can be reduced to a simpler shape by separating a sequence. Memorizing them speeds up the counting process but is not required.

- - Separating
 - **H** wait to **H**.
- $\overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{\circledast}{\circledast} \overset{waits on}{\circledast} \overset{\circledast}{\circledast} \overset{w}{\circledast} \overset{w}{=} \overset{w}{\approx} \overset{w}{\circledast} \overset{w}{=} \overset{w}{\approx} \overset{w}{\approx} \overset{w}{=} \overset{w}{\approx} \overset{w}{\approx} \overset{w}{=} \overset{w}$

 - This example shows how the same sequence can extend more than one wait.

- 「蓋」「蓋」「薑」「蓋」「蓋」、waits on 「蓋」(III-「蓋).

 - o 伍益基 extends the 盟 single wait to 基.
- - Separating [] [] [] [] []] shows the <math>[] [] [] [] []] waits.
 - \circ $\left[\frac{1}{2}\right]\left[\frac{1}{2}\right]\left[\frac{1}{2}\right]$ extends the $\left[\frac{1}{2}\right]$ single wait to $\left[\frac{1}{2}\right]$.
- $\begin{array}{c} & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & &$
 - Separating set of the set of th
- 二二二四四伍高 waits on 三 (四)-左.
 - o Separating 🏼 🌋 shows the 🗟 🖫 waits.
 - 國伍當 extends the 盟 single wait to 氢. 0
- •

 - **H H** does not extend any waits.
 - This example shows that some sequences do not extend any nearby waits.

Categories of Hands

For the purposes of applying this method, hands are categorized according to how many copies of the two outermost tiles it has. Each hand can belong to two categories: one counting from each end. If these are different, the hand counts as the easier category to read.

For example:

- • hand from the high end. Single-pair hands are easier to read, so $\begin{array}{c} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & \\ & & \\ &$
- • hand from the high end. Single-triplet hands are easier to read, so 二三三三四四四位伍武玄玄玄 is a single-triplet hand.

The category a hand belongs to dictates how it should be counted to avoid missing any waits. The remainder of this article explores each category in depth, in increasing order of difficulty:

- Single-single, single-pair
- Pair-(any)
- Single-triplet
- Triplet-single, triplet-pair, quad-single, quad-pair
- Single-quad
- Triplet-triplet, triplet-quad, quad-triplet

Single-Single and Single-Pair Hands

For these hands, the main counting method can be used without further consideration. For reference, the method is:

- Separate one sequence from the end of the hand.
- Compare the resulting partial hand with a list of memorized core shapes.
 - If a memorized shape matches, proceed to the next step.
 - If no memorized shape matches, and the remaining hand is still a single-single or single-pair hand, separate another sequence and try again.
- List the waits of the core shape. Note which waits can be considered single waits.
- Add the separated sets back to the hand. If this extends any existing waits, list the new waits.
 - Repeat until all separated sets are added.
 - Sets can be added in any order.

Example: $\bigotimes_{a} \bigotimes_{a} \bigotimes$

- 4. $\left(\begin{array}{c} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ \end{array}\right)$ waits on $\left(\begin{array}{c} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ \end{array}\right)$

- 7. Add 🛞 🚆 🖏 back to the hand. 🎯 🚆 🖏 does not extend any waits.

Note that Step 2 resulted in a derived core shape. If **Example 3** was memorized, steps 3 and 5 become unnecessary.

Example: 憲憲憲憲憲國國國憲憲憲憲

- 1. $\boxed{\underline{x}}$ $\underline{\underline{x}}$ \underline
- 2. $\boxed{\underline{x} = \underline{x} = \underline{$
- 3. $\boxed{\underline{s} \pm \underline{s}} = \boxed{\underline{s}} = \boxed{\underline{s}} = \boxed{\underline{s}} = \boxed{\underline{s}} = \underline{s}$ is a single-pair hand. Separate $\boxed{\underline{s}} \pm \underline{\overline{s}} = \boxed{\underline{s}}$. The hand is now $\boxed{\underline{s}} \underline{\underline{s}} \underline{\underline{s}} = \boxed{\underline{s}} = \underline{\underline{s}} = \underline{$
- 4. 「三三〇〇〇 waits on 〔二-(〇〇).
- 5. Add $\overline{\underline{a}}$ $\overline{\underline{a}}$ $\overline{\underline{a}}$ back to the hand. $\overline{\underline{a}}$ $\overline{\underline{a}}$ $\overline{\underline{a}}$ extends the $\overline{\underline{a}}$ single wait to $\overline{\underline{a}}$, turning the existing $\overline{\underline{a}}$ wait into a single wait, so $\overline{\underline{a}}$ $\overline{$
- 6. Add $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ back to the hand. $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ extends the $\underline{\mathbb{Z}}$ single wait to $\underline{\mathbb{Z}}$. $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ $\underline{\mathbb{Z}}$ waits on $(\underline{\mathbb{Z}}$ - $\underline{\mathbb{Z}}$)- $\underline{\mathbb{Z}}$.
- 7. Add 출출 back to the hand. 불술 출 does not extend any waits.
- 8. $\overline{\underline{\mathbf{z}}} = \overline{\underline{\mathbf{z}}} =$

Note that a shortcut applies for this hand. Since separating sequences revealed that the hand has **no pair** wait and **no concealed triplet**, the whole hand can wait on at most one *suji*. If $[\underline{\underline{s}}]$ and $[\underline{\underline{s}}]$ are

Example:

- 3. IIIIIIIII doesn't add any waits. It waits on III-IIII (IIII). The empty wait (IIII) must be counted during this step because empty waits can still be extended.
- 4. Add **HEAD** back to the hand. **HEAD** extends the **HEAD** single wait to **HEAD**, and extends the **HEAD** waits on **HEAD** (**HEAD**).
- 5. Add $\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ back to the hand. $\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ does not extend any waits.

Exercises:

Pair-(any) Hands

The outer pair can be used as the head, or as part of two sequences. Thus, two cases need to be considered:

- Assume the pair belongs to two sequences.
 - \circ If the two sequences are missing more than one tile, the pair can only be the head.
 - \circ $\;$ If the two sequences are complete, separate them and count the rest of the hand.
 - If the two sequences are missing one tile, the hand waits on it if the rest of the hand is complete.
- Assume the pair is the head.
 - \circ $\;$ With a confirmed head, the rest of the hand tends to be easy to read.

Adding the waits from these two cases together gives all of the hand's waits.

Example: (a) (

- 1. Assume $\begin{bmatrix} \bullet & \bullet \\ \bullet & \bullet \end{bmatrix} = b$ is part of two sequences.
 - a. Separate $\left[\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & &$
 - b. (♣ ♣ ♣ ♣ ♥ ♣ waits on (♣ ♠ ♦ (♠).
 - c. Add $(\mathbb{C}, \mathbb{C}, \mathbb{$
- - a. Separate $\left[\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right]$ resulting in $\left[\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right]$ $\left(\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right)$ $\left(\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right)$ $\left(\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right)$ $\left(\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right)$ $\left(\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right)$ $\left(\begin{smallmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{smallmatrix}\right)$
 - b.
 completes a triplet, so it can form a pair wait with an existing head. In this case,
 b.
 b.
 b.
 completes a triplet, so it can form a pair wait with an existing head. In this case,
- 3. Adding the two cases together, ()

- 1. Assume $\begin{bmatrix} \underline{4} \\ \underline{3} \end{bmatrix}$ is part of two sequences.
 - a. Separate $\overline{\underline{z}}$ $\overline{$
 - b. $\overline{\underline{s}}$
 - c. Add 蓋蓋翼翼簧簧 back to the hand. 蓋蓋翼翼簧簧 extends the 蓋 wait to 囊.

- d. $\boxed{\underline{z}}$ $\underbrace{\underline{z}}$ \underbrace{z} $\underbrace{\underline{z}}$ $\underbrace{\underline{z}}$ $\underbrace{\underline{z}}$ \underbrace{z} \underline{z} \underbrace{z} \underbrace{z} \underline{z} \underbrace{z} \underline{z} \underline{z}
- - b. 蓋蓋蓋屬國國國 waits on 臺. This completes a triplet, so it can form a pair wait with an existing head. In this case, 鎥鎥 is the existing head.
 - c. $\overline{\underline{z}} = \overline{\underline{z}} = \overline$
- 3. Adding the two cases together, 蓋蓋蓋屬醫醫醫醫 # waits on 蓋- 之 (鬻) 鎥.

- 1. Assume $\begin{bmatrix} I & I \\ I & I \end{bmatrix}$ is part of two sequences.

 - - i. This is a seven-tile independent core shape. If not memorized, it can be analyzed as if it were a hand.
- 2. Then, assume $\begin{bmatrix} I \\ I \\ I \end{bmatrix}$ is the head.

Exercises:

Single-Triplet Hands

Single-triplet hands can be simplified to pair-(any) hands by separating the outer sequence, with the following caveats:

- The hand may also have a single wait on its outermost singleton.
- After analyzing the pair-(any) partial hand, its waits may be extended by the previously separated sequence.

$\mathsf{Example:} \textcircled{\textcircled{\baselinetwidth{\mathbb{B}}}}{\textcircled{\baselinetwidth{\mathbb{B}}}} & \textcircled{\baselinetwidth{\mathbb{B}}}{\textcircled{\baselinetwidth{\mathbb{B}}}} & \textcircled{\baselinetwidth{\mathbb{B}}}{\includegraphics{\baselinetwidth{\mathbb{B}}} & \textcircled{\baselinetwidth{\mathbb{B}}}{\includegraphics{\baselinetwidth{\mathbb{B}}} & \textcircled{\baselinetwidth{\mathbb{B}}}{\includegraphics{\baselinetwidth{\mathbb{B}}} & \textcircled{\baselinetwidth{\mathbb{B}}} & \rule baselinetwidth{\B}} & \rule baselinetwidth{\B}}$

Although this is a single-single hand, separating does not reduce the remainder to a known core shape, nor does it become another single-single or single-pair hand. It must be analyzed as a single-triplet hand.

- 1. The hand has a single wait on ().
- 2. Separate \mathfrak{B} \mathfrak{B} and \mathfrak{B} \mathfrak{B} resulting in \mathfrak{B} \mathfrak{B}
- 3. $\begin{array}{c} & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ &$
 - a. This is a basic seven-tile core shape and should be memorized.
- 4. Add 🛞 😤 👘 back to the hand, which doesn't extend any waits.
- 5. Bartis on (Bartis)

Example: 言意言罵罵罵罵罵罵罵罵罵罵罵

- 1. The hand does not have a single wait on $\overline{\underline{s}}$.
- 2. Separate $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ resulting in $\overline{\underline{s}}$ $\overline{\underline{s}}$
- 3. Assume 🗟 🗟 is part of two sequences.
 - a. Separate $\overline{\underline{z}}$ $\overline{$

 - c. Add 臺臺罂罂霉醬 back to the hand. 臺臺罂罂霉醬 extends the 춟 single wait to 臺, and extends the 鎥 wait to 毫.
 - d. $\overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}}$, assuming $\overline{\underline{s}} = \overline{\underline{s}}$ is part of two sequences, waits on $\overline{\underline{s}} \overline{\underline{s}} \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{s}}$.

- 4. Assume 🚋 is the head.
 - a. Separate 🗟 🗟 resulting in 🗟 🗟 📓 📓 🖉 📓 📓 🛣 🚊 🛣
 - b. $\boxed{\textcircled{magenta}}$ $\boxed{\textcircled{magen$
 - c. $\overline{\underline{s}} = \underline{\underline{s}} = \underline$
- 5. 三三四四伍伍荒左左荒 waits on 三 伍 寇 (嘉 応).
- 6. Add $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ back to the hand, which doesn't extend any waits.
- 7. $\overline{\underline{z}} = \overline{\underline{z}} = \overline$

Step 3 can be simplified by recognizing 臺臺躍躍靈靈盜盜盜盜盜盜 as the seven-tile derived core shape 臺麗靈靈盜盜盜盜盜 with an additional 臺麗靈.

This example shows that even when a single-triplet hand does not have a single wait on its outermost singleton, it may still wait on that tile via other parts of the hand.

- 1. The hand has a single wait on $\begin{bmatrix} I \\ I \end{bmatrix}$.
- - - i. This is a seven-tile independent core shape. If not memorized, it can be analyzed as if it were a hand.
- 4. Add **Add Solution** back to the hand, which extends the **single** wait to **solution** (already counted), and extends the **solution** extends the **solution**.
- 3. $\underbrace{1}_{1}\underbrace{1}\underbrace{1}_{1}\underbrace{1}\underbrace{1}_{1}\underbrace{1}\underbrace{1}\underbrace{1}_{1}\underbrace{1}\underbrace{1}\underbrace{1}_{1}\underbrace$

Exercises:

Triplet-Single and Triplet-Pair Hands

For triplet-single hands, the triplet is either a triplet, or the head plus part of a sequence. Both cases must be examined separately.

Example: \bigotimes_{\otimes} $\bigotimes_{$

- 1. Assume 🕷 🕷 🕷 is a triplet.
 - a. Separate $(a) \otimes (a) \otimes (a)$
 - - i. This is a seven-tile independent core shape. If not memorized, it can be analyzed as if it were a hand.
 - c. Add $\left[\begin{array}{c} & & \\ & & \\ & & \\ & & \\ \end{array} \right]$ back to the hand, extending the $\left[\begin{array}{c} & & \\ & & \\ \end{array} \right]$ single wait to $\left[\begin{array}{c} & & \\ & & \\ \end{array} \right]$.
 - d. Add 🔹 🐩 back to the hand, extending the 🖏 single wait to 🚳
 - e. $\bigotimes_{\mathfrak{B}} \bigotimes_{\mathfrak{B}} \bigotimes_{\mathfrak{B}} \bigotimes_{\mathfrak{B}} \otimes \otimes_{\mathfrak{B}} \otimes_{\mathfrak{B}} \otimes \otimes_{\mathfrak{B} \otimes_{\mathfrak{B}} \otimes \otimes_{\mathfrak{B}} \otimes_{\mathfrak{B}} \otimes \otimes_{\mathfrak{B}} \otimes_{\mathfrak{B}} \otimes \otimes_{\mathfrak{B}} \otimes$ waits on 🛞 - 👘 - 👘 (👘 - 👘) -
- 2. Then, assume $\left[\begin{array}{c} & \\ & \\ \end{array} \right] \left[\begin{array}{c} & \\ & \\ \end{array} \right]$ is the head.
- waits on 🛞 - 👘 - 👘 (👘 - 👘) - 🗰

Example: 二二二三四伍伍克克克左左左

- 1. Assume 🗟 🗟 🗟 is a triplet.
 - a. Separate $\overline{\underline{z}}$ $\overline{\underline{z}}$ $\overline{\underline{z}}$ and $\overline{\underline{z}}$ $\overline{\underline{z}}$ $\overline{\underline{z}}$ resulting in $\overline{\underline{z}}$ \overline{z} $\overline{\underline{z}}$ \overline{z} \overline{z} \overline{z}
 - b. $\begin{bmatrix} \underline{\omega} \\ \underline{z} \\ \underline{$
 - i. This is a seven-tile independent core shape. If not memorized, it can be analyzed as if it were a hand.
 - c. Add 🗟 🖀 back to the hand, extending the 🔮 single wait to 🗟
 - d. Add $\left[\overline{a}\right] \left[\overline{a}\right]$ back to the hand, which doesn't extend any waits.
 - e. $\left[\frac{1}{2}\right] = \left[\frac{1}{2}\right] = \left[\frac{1}{2}\right]$ waits on [2]- [蓋] (伍) [流].

- 2. Then, assume 🗐 🗟 is the head.
 - a. Separate 🗟 🗟 and 🗟 🗟 🖫 resulting in 🗟 🗟 🗟 🗟 🗟 🗟 🗟 🗟 🗟 🗟 🗟 着
 - b. 🖀 🛱 🚊 🛱 📓 🛓 🛓 📓 waits on 🖀 🛣 . Out of these, 🖀 completes a triplet, so it can form a pair wait with an existing head. In this case, $\left[\overline{\mathfrak{s}} \mid \overline{\mathfrak{s}} \mid \right]$ is the existing head.
 - c. Add 🗟 🗟 📓 back to the hand, which doesn't extend any waits.
 - d. $\overline{\underline{s}}$ $\overline{\underline{s}}$, assuming $\overline{\underline{s}}$ $\overline{\underline{s}}$ is the head, waits on $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$.
- waits on [翼]-[蓋] [蓋]-((蘆))-(蘆) [蘆].

Triplet-pair hands are counted in the same way as triplet-single hands. The only additional case is when the outer 8 tiles are waiting on the second-outermost tile to complete three identical sequences. This case is easy to identify because there's only 5 remaining tiles after separating those 8.

- 1. The hand waits on $\begin{bmatrix} I \\ I \end{bmatrix}$ to complete three identical sequences.
- - a. Separate analyzed as a pair-(any) hand.
 - b. Assuming **b** is part of two sequences, separating the sequences results in

 Image: Image:
 - with
 - waits on H-III II (III).
- 3. Assume $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ is the head.
 - a. Separate $\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$, $\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$, and $\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$ resulting in
 - b. I waits on . of which completes a triplet, forming a pair wait with the existing head $\begin{bmatrix} 1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
 - $\underbrace{1}_{\underline{H}}\underbrace{1}_{\underline{H$ c.
- 4. Adding the cases together, **H**

Exercises:

Quad-Single and Quad-Pair Hands

These hands simplify to triplet-single hands (or triplet-none hands, which are counted the same way) after separating an outer sequence. Count the resulting triplet-single hand, then add any extended waits from the separated sequence.

Single-Quad Hands

Attempt to simplify single-quad hands to triplet-single or triplet-pair hands by separating the outer sequence, with the following caveats:

- Not all single-quad hands can be simplified this way. If the hand cannot be simplified this way, still separate the outer sequence, then refer to the next section.
- The hand may also have a single wait on its outermost singleton.
- After analyzing the triplet-single or triplet-pair partial hand, its waits may be extended by the previously separated sequence.

- 1. The hand does not have a single wait on $\begin{bmatrix} \bullet & \bullet \\ \bullet & \bullet \end{bmatrix}$.
- - b. Assuming $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ is the head results in $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$, which waits on $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ and forms a pair wait with $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ for a total of $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$.

 - d. (if unsure how this result is obtained, refer to the Triplet-Single Hands section).
- 3. Add $\left[\begin{array}{c} \bullet & \bullet \\ \bullet & \bullet \end{array} \right] \left[\begin{array}{c} \bullet & \bullet \\ \bullet & \bullet \end{array} \right]$ back to the hand, which extends the $\left[\begin{array}{c} \bullet & \bullet \\ \bullet & \bullet \end{array} \right]$ single wait to $\left[\begin{array}{c} \bullet & \bullet \\ \bullet & \bullet \end{array} \right]$.

Exercises:

All Other Hands

The following hand types have not yet been covered:

- Triplet-triplet
- Triplet-quad
- Quad-triplet
- Quad-quad (cannot exist in 13-tile mahjong)

These hands contain too many permutations to be analyzed using the main method, but hands where *both* ends are this complicated are so rare, there's only 6 of them (in 13-tile mahjong) excluding slides and reflections. They can be memorized if desired.

- 1. 國際國賃賃賃賃 waits on 臺-臺, empty wait on (蛋).
- 2. HERE HERE WAITS ON HERE HERE WAITS ON HERE AND HERE WAIT ON (HERE).
- Sequivalent to
- 4. <u>「蓋」「蓋」「蓋」「」」「」」。</u> waits on <u>「</u>」」。 This is equivalent to Case 2.
- 5. **H**
- 6. $\begin{array}{c} & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & &$

Closing

This article presents a systematic algorithm to read complex waits that applies to all hands. No guesswork is required at any stage. With practice, it can be very fast, to the point of reading most possible hands in a few seconds, and there's always more room to improve.

I would like to thank the original author 纯全三色对对和 (<u>https://space.bilibili.com/8158016</u>) for writing this article's source material. If you can read Chinese, their other works are definitely worth reading too.

Extra Section 1: 10-Tile Core Shapes

Players who have mastered the main counting method may improve their speed further by memorizing additional, 10-tile core shapes. The following is a non-exhaustive list of the most frequent ones:

- $\boxed{\ddot{z}}$ \ddot{z} $\ddot{z$
- $(\overset{\otimes}{\otimes} \overset$
- $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ $\boxed{\ddot{z}}$ waits on $(\boxed{\ddot{z}})$ $\underbrace{\ddot{a}}$ $\boxed{\ddot{z}}$.
- \mathfrak{B} \mathfrak{B}
- 言言言言言聞聞伍伍伍 waits on 富-二 言 (言).
- $\left[\begin{array}{c} 1\\ 1\end{array}\right] \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\\ 1\end{array}\right] \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array}\right] \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array}\right] \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array}\right] \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array} \left[\begin{array}{c} 1\end{array}\right] \left[\begin{array}{c} 1\end{array} \left[\end{array}\\\\[c\\ [\end{array} \left[\begin{array}{c} 1\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} [\left[1\end{array} \left[\end{array}\\[c\end{array} \left[\end{array}\\[c\end{array} [\left[1\end{array} \left[\end{array}\\[c\end{array} \left[\left[1\end{array} \left[\end{array}\\[c\end{array} \left[\left[1\end{array} \left[\left[\left[1\end{array} \left[\left[\left[1\end{array} \left[\left[1\end{array} \left[\left[1\end{array} \left[\left[\left[1\end{array} \left[\left$
- (\mathfrak{B}) (\mathfrak{B})
- $\overline{\underline{z}}$ \overline{z} \overline{z} \overline{z} \overline
- $(\overset{\otimes}{\otimes}\overset{\otimes}$
- 二言言言罵四四伍六六京 waits on 言一伍 言, 二二 (四).

Extra Section 2: Multiple Sequences

Being able to separate more than one sequence at a time is one key to reading hands quickly. Some combinations of multiple sequences don't look like such at first glance and are worth learning.

- 🔹 💩 💩 💩 💩 💩 💩 🖏 🖏 is two sequences.
- 「三三四四個個点」 is three sequences.

Exercises: quickly separate sequences and determine the wait.

北北三四四伍伍六六七 KKEBEBEBEE 北北。 北北三四四四位低六六 北北國。。。。。。。。。。。。。。。 北北嘉嘉嘉嘉嘉嘉嘉嘉嘉嘉

Extra Section 3: Common Extensions

Some shapes are extended by nearby completed sequences and/or triplets often enough that the shape plus extension can be considered a core shape on their own. At the same time, some other shapes look like extensions, but don't gain any additional waits. The following is a non-exhaustive list.

- Base shape: 🏶 👘 👘 👘 兆比 waits on 🛞 👘 比.
- Base shape: 蓋蓋躍蠶蓋塗 waits on (蓋-蛋-釜).
 - $\circ \quad \text{Variation: } \underline{\vec{s} \cdot \vec{s}} = \underline{\vec{s}} = \underline{\vec{s}}$
 - $\circ \quad \text{Variation: } \overline{\underline{s}} \underbrace{\overline{s}} \overline{\underline{s}} \underbrace{\overline{s}} \underbrace$
- - Variation:
- Base shape: A gradient of the second s
 - $\circ \quad \text{Variation:} \quad \textcircled{\textcircled{\baselineskip}{\baselineskip} \\ \hline \end{tabular} \begin{tabular}{c} \label{eq:tabular} \\ \end{tabular} \\ \hline \end{tabular} \begin{tabular}{c} \label{eq:tabular} \\ \end{tabular} \\ \end{tabular} \begin{tabular}{c} \label{eq:tabular} \\ \end{tabular} \\ \end{tabular} \begin{tabular}{c} \label{tabular} \\ \end{tabular} \\ \end{tabular} \\ \end{tabular} \\ \end{tabular} \begin{tabular}{c} \label{tabular} \\ \end{tabular} \\ \end{tabular} \begin{tabular}{c} \label{tabular} \\ \end{tabular} \\ \end{tabular} \\ \end{tabular} \\ \end{tabular} \\ \end{tabular} \\ \end{tabular} \begin{tabular}{c} \label{tabular} \\ \end{tabular} \\ \e$
- Base shape: 蓋蓋蓋靈燈蓋 waits on 홃-靈-蓋 (蓋).

 - $\circ \quad \text{Variation: } \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{\mathtt{s}}}} \overline{\underline{\mathtt{s}}} \overline{\underline{$
 - $\circ \quad \text{Variation:} \quad \boxed{\underline{\mathtt{s}}} = \underbrace{\overline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}_{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{s}}} \underbrace{\underline{\mathtt{s}}} \underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underline{\mathtt{s}} \underline{\mathtt{s}} \underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underline{\underline{\mathtt{s}}} \underbrace{\underline{\mathtt{s}}} \underline{\mathtt$
 - Variation: $\overline{\underline{a}} = \overline{\underline{a}} = \overline$
 - Variation: $\overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a}} \overline{\underline{a}} \underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}} \overline{\underline{a}}} \overline{\underline{a$
- Base shape:
 - Variation:
- - $\circ \quad \text{Variation:} \begin{tabular}{c} & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & & \\ & & & & \\$
 - $\circ \quad \text{Variation:} \overset{\textcircled{\baselineskip}}{\circledast} \overset{\textcircled{\baselineskip}}{\longleftrightarrow} \overset{\textcircled{\baselineskip}}{\circledast} \overset{\textcircled{\baselineskip}}{\circledast} \overset{\textcircled{\baselineskip}}{\circledast} \overset{\textcircled{\baselineskip}}{\circledast} \overset{\textcircled{\baselineskip}}{\circledast} \overset{\textcircled{\baselineskip}}{\longleftrightarrow} \overset{$
- Base shape: 這意意選及意意 waits on 意 (圖-監).
 - Variation: $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ waits on $\overline{\underline{s}}$ ($\underline{\underline{w}}$ $\underline{\underline{s}}$) $\underline{\underline{s}}$.
- - $\circ \quad \text{Variation:} \quad \boxed{1} \quad \$

- - $\circ \quad \text{Variation:} \overset{\textcircled{\baselineskip}{\baselineski$
- Base shape: 臺臺臺國國德黨 waits on (臺)-臺 國 舊.
 - Variation: $\boxed{\underline{s}}$ $\underline{\overline{s}}$ $\underline{\overline{s}}$ waits on $\underline{\overline{s}}$ $\underline{\overline{s}}$ $(\underline{\overline{s}})$ $\underline{\overline{s}}$ $\underline{\overline{s}}$.
 - Variation: $\overline{\underline{a}} = \overline{\underline{s}} = \overline{\underline{s}} = \overline{\underline{a}} = \overline{\underline{s}} = \overline$
- - $\circ \quad \text{Variation:} \quad \boxed{1} \quad \$
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- Base shape: 🗐 🗐 🗐 🗐 📓 🏾 🏾 🖉 🖉 🖉 waits on 😨 🖫 🛱 (臺).

 - Variation: $\boxed{\boxed{\boxed{\boxed{\boxed{1}}}}$
 - $\circ \quad \text{Variation:} \quad \boxed{\underline{\mathtt{s}} \ \underline{\mathtt{s}} \ \underline{$
 - $\circ \quad \text{Variation: } \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{\mathbf{s}}} \overline{\underline{\mathbf{s}}}} \overline{\underline{$
 - $\circ \quad \text{Variation:} \quad \boxed{\underline{\mathtt{s}} \ \underline{\mathtt{s}} \ \underline{\mathtt{s}}} \ \underline{\mathtt{s}} \ \underline$

 - Variation: 這這這這意識認識認識 waits on 遠 (臺) 僅.
- - $\circ \quad \text{Variation:} \quad \underbrace{1}_{1} \underbrace{1} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1$
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- - $\circ \quad \text{Variation:} \overset{(*,*)}{\oplus} \overset{(*,*)}{\oplus$
 - $\circ \quad \text{Variation:} \overset{(*,*)}{\circledast} \text{waits on } \overset{(*,*)}{\circledast} \overset{(*,*)}{\varepsilon} \overset{(*,*)}{$

- Base shape: $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ $\overline{\underline{s}}$ waits on $\overline{\underline{s}}$ -($\underline{\underline{s}}$) $\overline{\underline{s}}$.
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 - Variation: 臺蓋蓋屬屬屬屬蓋蓋基 waits on 蓋-(麕) 屬 之 0
 - Variation: $\overline{\underline{z}} = \overline{\underline{z}} = \overline$
- Base shape: $\left(\begin{array}{c} & & \\ & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ & & \\ \end{array} \right)^{\ast} \left(\begin{array}{c} & & \\ \end{array} \right)^$
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