MLAG ADVENTUROUS ON-SETS® Tournament Rules 2017-18

I. Starting a Match (Round)

A. Two- or three-player matches will be played. A *match* is composed of one or more shakes. A *shake* begins with the rolling of the cubes, the dealing of some cards, and the setting of a whole number as the Goal for that shake. A shake ends with at least one player attempting to write a *Solution* that both equals the Goal and correctly uses the cubes on the playing mat.

B. The following equipment is needed to play the game.

1. 16 cards: each card contains a unique combination of zero to four dots colored blue (B), red (R), green (G), or yellow (Y). No card contains more than one dot of any color. At the start of a shake, some of these cards are dealt face up to form the *Universe* for that shake.

Comment Players should make sure all 16 cards are in the game, with no duplicates. One of the cards is blank.

2. 18 cubes: these consist of the following groups.

a. 3 digit cubes: each face has one of the digits 1 through 5.

Comment The digit cubes are used only in setting the Goal.

b. 8 color cubes: each face has a dot colored B, R, G, or Y. Each dot names the set of all cards in the Universe that contain a dot of that same color.

c. 4 operation cubes: each face has one of the symbols U, ∩, −, or '.

(i) U means the *union* of two sets.

Example B U G is the set of cards in the Universe that are *either* B or G.

(ii) ∩ means the *intersection* of two sets.

Example R ∩ Y is the set of cards that are *both* R and Y.

(iii) − means set *subtraction*.

Example B − Y is the set of cards that are B *but not* Y.

(iv) ' means the *complement* of a set.

Example G' (often read "green prime") is the set of cards that are *not* G.

d. 3 Restriction cubes: each face has one of the symbols V, Λ, =, or C̲.

(i) V names the set of all the cards in the Universe for the shake.

(ii) Λ names the set of no cards (the null or empty set).

(iii) = and C̲ are special operators used to make mathematical statements about the cards in the Universe. Each such statement is called a *Restriction*. (See Section **VI-B** below.)

Comment The = and C̲ symbols are not used in the Elementary Division. Instead, before the cubes are rolled, the Goal-setter first sets out either two V and one Λ cube or one V and two Λ cubes. Then the remaining cubes are rolled.

3. A playing mat: this contains four sections.

a. Goal: digit cubes played here form the Goal.

b. Required: all cubes played here *must* be used in any Solution.

c. Permitted: any or all cubes played here *may* be used in any Solution.

d. Forbidden: *no* cube played here may be used in any Solution.

Comment Many games have a section labeled "Resources." However, any reference in these rules to the "playing mat" or the "mat" does not include the Resources section.

4. A one-minute sand timer: this is used to enforce time limits.

5. A challenge block: This is a cube or similar object and not a flat object like a coin. It should not be so large that two players can grab it simultaneously.

C. Players may use only pencils or pens, blank paper, and (for Adventurous On-Sets) variation sheets. No prepared notes, books, tables, calculators, cell phones or other electronic devices may be used except that players' paper may contain preprinted Universe charts on which the cards that are dealt may be marked.

> *Comment*   The chart a player uses may not have sets pre-shaded or pre-marked in any way. (See Appendix **B** for samples.)

D. The Goal-setter for the first shake is determined by lot. On each subsequent shake, the Goal-setter is the player immediately to the *left* of the previous Goal-setter.

> To determine the first Goal-setter, each player rolls a digit cube. The player rolling the highest digit sets the first Goal. Players tied for high digit roll again until the tie is broken.

II.   Starting a Shake

A. To begin a shake, the Goal-setter rolls all 18 cubes. The symbols on the top faces of the rolled cubes form the *Resources* for the shake.

1. A shake begins as soon as the timing for rolling the cubes and dealing the cards is started or the cubes are rolled or the first card is dealt.

2. During a shake, no player may turn over a cube or obstruct the other players' view of any cube. (See Section **IX-C**.)

3. In Elementary Division, the three Restriction cubes are not rolled. Instead the Goal-setter first sets out either two ∨ and one ∧ cube or one ∨ and two ∧ cubes. Then the remaining cubes are rolled.

B. While the Goal-setter rolls the cubes, the player to the *right* of the Goal-setter shuffles and deals the cards.

1. In Elementary, Middle, and Junior Divisions, at least six but no more than 12 cards must be dealt.

2. In Senior Division, at least 10 but no more than 14 cards must be dealt.

> After the cards are dealt and positioned in a manner agreeable to all players, no one may touch them or in any way obstruct the other players' view of them until Solutions are checked. (See Section **VII-C**.) However players may look at the cards that were not dealt (usually for purposes of making their charts)

> *Comment*   The dealer may not take back a card that has been dealt unless the number of cards exceeds the maximum allowed in the division. In that case, the extra card(s) must be removed from the Universe.

C. In Adventurous On-Sets, after the cubes have been rolled and the cards have been dealt but before the Goal is set, each player must select a variation from the appropriate list in Section **XIII** of these rules. A *variation* is a special rule that, if it conflicts with any of the regular tournament rules, supersedes those rules.

1. The Goal-setter makes the first selection, then the player to the left of the Goal-setter, then the third player if there is one.

a. Each player has 15 seconds to make a variation selection.

b. To begin a shake, the Goal-setter has one minute to roll the cubes. At the end of this minute, she has 15 seconds to select a variation. However, if the Goal-setter selects a variation before the minute for rolling the cubes expires, the next player has the rest of that minute plus 15 seconds to select a variation. If the second player also selects a variation before that

minute expires, the third player (if there is one) has the rest of that minute plus 15 seconds to select.

   c. A player selects a variation by circling its name in the list for that shake. This list is located on the reverse side of the scoresheet or on a separate sheet. For certain variations (e.g., required cube, wild cube, Double Set), the player must also fill in a blank to indicate which cube is required or wild, which set counts double, and so on.

   2. If a player selects a variation that has no effect on the shake, a variation that conflicts with one already chosen for the shake, or a variation that has already been chosen for the shake, the player loses one point and must pick another variation. If, on the second try, the player still does not select an appropriate variation, he loses another point and may not pick a variation for that shake.

   If a player's illegal variation selection is not pointed out before the next player selects a legal variation or a legal Goal is set (whichever comes first), the player making the illegal selection is not penalized. However, the illegal variation is ignored for the shake.

   Examples   It is illegal to choose U Required when no U cube was rolled, Y Wild when no Y cube is in Resources, or (in Middle, Junior, and Senior) No Null Restrictions when no = or C̲ cube was rolled (and no Wild Cube has been chosen).

   **3.** In two-player matches in Elementary, Middle and Junior Divisions, the player who is not the Goal-setter must select *two* variations for the shake. In Senior Division, any player may pick two variations for any shake in either a two- or three-player match.

   A Player picking two variations must select both within the 15 second time limit (See Section **XI-A-1-b**).

III. Setting the Goal

   A. The player who rolls the cubes must set a Goal by transferring the cube(s) of the Goal from Resources to the Goal section of the playing mat.

   B. A Goal consists of at least one and at most three digit cubes that form an expression that names a whole number.

   1. If more than one cube is used to set the Goal, the way the cubes are placed in the Goal determines the Goal's value.

   a. The sum of two numbers is indicated by placing the cubes in a horizontal line (side by side).

   b. The product of two numbers is indicated by placing the cubes in a vertical line.

   c. The negative of a number is indicated by placing the cube so that its numeral is upside-down.

The following are the only legal configurations for the Goal:

Goal	Meaning	Goal	Meaning
A	A	A B C	A x B x C
A B	A + B		
A B C	A + B + C	A B C	(A x B) + C
A B	A x B	A B C	A x (B + C) or (AxB) + (AxC)
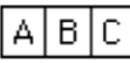
Comment Any digit cubes not used in the Goal must be placed in Forbidden since they are not used in Solutions.

2. Once a digit cube touches the Goal section of the mat, it must be used in the Goal.

   a. The Goal-setter indicates the Goal has been set by saying "Goal."

   b. The Goal-setter may rearrange or regroup the cubes in the Goal section until she says "Goal."

   c. If the time runs out to set the Goal or the setter turns the timer, it has been set.

   d. The Goal may not be changed once it has been set.

C. Before moving the first digit cube to the Goal section of the mat, the Goal-setter may make a *bonus move*.

   1. To make a bonus move, the Goal-setter must say "Bonus," then move one non-digit cube (but not = or <u>C</u>) from Resources to Forbidden then set the Goal.

   2. A Goal-setter who is leading in the match may not make a bonus move.

   If the Goal-setter makes a bonus move while leading in the match and an opponent points out the error before the next player moves or someone legally challenges, the cube in Forbidden is returned to Resources. The Goal-setter also receives a one-point penalty.

D. If the Goal-setter believes no Goal can be set that has at least one correct Solution (see Section **VII**), he may declare "No Goal." Opponents have one minute to agree or disagree with this declaration.

   1. If all players agree, that shake is void and the same player repeats as Goal-setter for a new shake.

   Comments

   (a) The Goal-setter would declare "No Goal" only in those rare instances when an unusual set of Resources was rolled. For example, there are three 1's, the operations are all U signs, and each color appears on at least four cards. (Even in this case, the Goal-setter might be able to pick a variation like wild cube that would allow a Goal to be set.)

   (b) Players receive no points for the void shake.

   (c) If the Goal-setter makes a Bonus move, he is committed to setting a goal and may not declare "No Goal"

   2. An opponent who does not agree with the "No Goal" declaration indicates disagreement by picking up the challenge block (see Section **V-B**) and

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challenging the "No Goal" declaration. She then has two minutes to write a legal Goal and a correct Solution. If there is a third player, he also can choose to write a legal Goal and a correct Solution.

Note: The Challenger (and third party, if he agrees) can use as many cubes from Resources as needed. See Section **X** for scoring.

IV. Moving Cubes

A. After the Goal has been set, play goes in a clockwise direction (to the left).

B. When it is your turn to play, you must either move a cube from Resources to one of the three sections of the playing mat (Required, Permitted, Forbidden) or challenge the last Mover.

The move of a cube is completed when it touches the mat. Once a cube is legally moved to the mat, it may not be moved again during the shake. (Exception: When the Shift from Permitted variation is played – see Section **XIII** below.)

C. If you are not leading in the match, then on your turn you may take a bonus move before making a regular move.

   1. To make a bonus move, the Mover must say "Bonus," then move a cube from Resources to Forbidden, then another cube to Forbidden, Permitted or Required.

   Comments

     (a) If you do not say 'Bonus' before moving the cube to Forbidden, the move does not count as a bonus move but as a regular move to Forbidden. You are not entitled to play a second cube.

     (b) When making a bonus move, the first cube *must* go to Forbidden. The second (bonus) cube may be moved to Required, Permitted, or Forbidden.

   2. If the player in the lead makes a bonus move and an opponent points out the error before another player makes a legal move or challenge, the Mover must return the second cube played on that turn to Resources. The Mover also receives a one-point penalty.

   Comments

     (a) Players tied for the lead may make Bonus moves.

     (b) Players often call "Bonus" and move two cubes simultaneously to Forbidden. If the player did not call "Bonus", he may return either of the two cubes to Resources.

D. In Middle, Junior and Senior Divisions, no = or C cubes may be played to Forbidden *until four or fewer cubes remain in Resources*.

   Comments

     (a) V and Λ *may* be played to Forbidden.

     (b) Allowing an = or C to be played to Forbidden with four or fewer cubes left in Resources is intended to cover those rare situations where a player would have no choice but to make a Solution possible with one more cube. For example, there may be a color cube and two = or C cubes left in Resources. If the color cube and either Restriction cube is needed for a Solution, then the Mover would have no choice but to play one of the three cubes to Required or Permitted. The exception above allows the player to move either the = or C cube to Forbidden to avoid a Now Challenge.

V. Challenging

A. Whether or not it is your turn, you may challenge another player who has just completed a move or set the Goal. The two main challenges are Now and Impossible.

Note Players may also challenge a "No Goal" call, see Section **III-D-2**.

1. By challenging *Impossible*, a player claims that no correct Solution can be written regardless of how the cubes remaining in Resources may be played.

Comments

(a) If the Goal is not a legal configuration (see Section **III-B-1**) or the Goal equals a negative number, an opponent should challenge Impossible.

(b) A Player who challenges "Never" will be considered to have challenged "Impossible". There will be no penalty for saying "Never" instead of "Impossible".

2. By challenging *Now*, a player claims that a Solution can be written using the cubes on the mat and *one* cube (or no additional cubes) from Resources.

   a. A player may challenge Now only if there are at least two cubes in Resources.

   If a player challenges Now with fewer than two cubes in Resources, the challenge is invalid and is set aside. The player who called Now also receives a one point penalty.

   Comment If only one cube remains in Resources and no one challenges Impossible, then a Solution is possible using that one cube. Since the latest Mover had no choice but to play the second-to-last Resource cube to the mat, it is not fair that he be subject to a Now challenge. (However, an Impossible challenge could be made.) See Section **VIII** for the procedure to be followed when one cube remains in Resources.

   b. Since a correct Solution must contain at least two cubes, it is illegal to challenge Now after the Goal has been set but before a cube has been played to Required or Permitted. If a player challenges Now before any cubes have been played to Required or Permitted, the challenge is invalid and is set aside. The player who called Now also receives a one point penalty.

B. A challenge block is placed equidistant from all players. To challenge, a player must pick up the block and say "Now" or "Impossible."

If a player picks up the block, then decides not to challenge (without saying "Now" or "Impossible"), the player accepts a one-point penalty and play continues. A player who picks up the block and makes a challenge against himself is also penalized one point, and the challenge is set aside.

Comments

(a) The purpose of the block is to determine who is the Challenger in a shake.

(b) Touching the challenge block has no significance. However, players may not keep a hand or finger on, over, or near the block for an extended period of time. (See Section **IX-C**.)

(c) A player must not pick up the challenge block for any reason except to challenge. For example, don't pick it up to say "Goal" or to charge illegal procedure or when fewer than two cubes remain in Resources.

VI. The Parts of a Solution

A. *Set-Name part:* this part consists of one legal Set-Name. A Set-Name is legal if it specifies a set of cards in the Universe and does not contain any symbol or group of symbols that is undefined in On-Sets.

= and C̲ cubes may not be used in the Set-Name of the Solution even if they are in Required. **If the Set-Name part of the Solution contains an = or C̲ symbol, it is automatically wrong.**

Examples of Set-Names   B, R', G ∪ Y, (R ∩ B) – Λ, (V – G)' ∪ R

Comments

(a) A Set-Name written on paper may contain pairs of grouping symbols such as parentheses, brackets or braces even though these do not appear on the cubes. These symbols indicate how the Solution-writer would physically group the cubes if the Solution were built with the cubes.

(b) The Solution-writer must not write "= Goal" after the Set-Name. Doing so makes the

Solution incorrect.

B. *Restriction part:* this part consists of one or more Restrictions.

1. A *Restriction* is a rule that is applied to the cards in the Universe. Any card that does not satisfy the Restriction is temporarily removed from the Universe while that Solution is being checked. After all Restrictions in the Solution have been applied to the Universe, the Solution-writer's Set-Name is worked out using the cards that remain in the restricted Universe.

   Comments
   (a) Any cards removed while checking a Solution are returned to the Universe before another Solution is checked.
   (b) Any Restrictions in a Solution apply to the Universe only for *that* Solution.

2. There are three types of Restrictions. Any set used in each type must be represented by a legal Set-Name.

   a. *Subset Restriction*: this type has the form *Set 1* C̲ *Set 2*. A card in the Universe does not satisfy a subset Restriction if it is in *Set 1* but not in *Set 2*.

   Examples B C̲ R', G − Y C̲ ∧, B − R C̲ (G ∩ V)', B U Y C̲ B U Y

   b. *Equals Restriction*: this type has the form *Set 1* = *Set 2*. A card in the Universe does not satisfy the Restriction if it is in one of the two sets but not in the other.

   Examples B = R, G − Y = V, (B ∩ G)' = Y − R, R = R

   c. *Chain Restriction*: this type has two or more = or C̲ cubes in it.

   (i) Restrictions of the following form are defined, where *A*, *B*, and *C* are sets.

   $$A \underline{C} B \underline{C} C \quad \text{(meaning } A \underline{C} B \text{ and } B \underline{C} C\text{)}$$
   $$A = B = C \quad \text{(meaning } A = B \text{ and } B = C\text{)}$$
   $$A \underline{C} B = C \quad \text{(meaning } A \underline{C} B \text{ and } B = C\text{)}$$
   $$A = B \underline{C} C \quad \text{(meaning } A = B \text{ and } B \underline{C} C\text{)}$$

   (ii) Restrictions of the following form also are permitted, where each one is worked out from left to right like those above.

   A C̲ *B* C̲ *C* C̲ *D*, *A* = *B* = *C* = *D*, *A* C̲ *B* C̲ *C* = *D*, *A* = *B* C̲ *C* C̲ *D*, and so on.

3. In a Restriction, no pair of parentheses (or other symbols of grouping) may enclose an = or C̲ symbol. However, a player may put parentheses around one side of a Restriction, like this: B C̲ (R U G).

   Comment A common error is putting parentheses around part of a chain Restriction, like this where *A*, *B*, and *C* are sets: (*A* C̲ *B*) C̲ *C*, *A* = (*B* = *C*), and so on. Such parentheses make the chain meaningless just as the parentheses in the algebraic equation (2x=3)+7 make it meaningless. Also these parentheses are inappropriate: (B = R)' However, this does not mean that parentheses may not be used at all in Restrictions. Parentheses may legitimately be placed within any Set-Name in a Restriction, as in the following examples.

   (R U B) − G = V, B = (G U R)' C̲ V, R' = B C̲ (R − Y) U V

   Notice in these examples that no pair of parentheses encloses an = or C̲.

VII. Writing and Checking Solutions

A. After a valid challenge, at least one player must write a Solution.

1. After a Now challenge, the Challenger must write a Solution. (The Mover may not present a Solution.)
2. After an Impossible challenge, the Mover must write a Solution. (The

Challenger may not present a Solution.)

3. After any challenge in a three-player match, the Third Party must decide **by the end of the two minutes for writing Solutions** whether to agree with the Challenger or the Mover. If the player with whom the Third Party agrees must write a Solution, then the Third Party must also write a Solution.

Comment To indicate his intention on the challenge, the Third Party may:

(a) state whether or not he will present a Solution;

(b) indicate which party, Mover or Challenger, the Third Party is "joining" (agreeing with) on the challenge. This can be done verbally or by pointing to the party.

(c) present or not present a Solution when the time limit for writing Solutions expires. If the Third Party does not present a Solution, she is assumed to be joining the player who is not writing a Solution. (Challenger on an Impossible or Mover on Now).

B. To be *correct*, a Solution must satisfy the following criteria:

1. The Solution contains a valid Set-Name part.

2. Middle, Junior, Senior only: The Solution contains a Restriction part if there are one or more = or <u>C</u> cubes in Required.

If no = or <u>C</u> cubes are in Required but some are in Permitted or Resources, the Solution *may* include a Restriction part.

3. The Solution equals the Goal. That is, the number of cards selected from the Universe by the Set-Name equals the Goal.

If the Solution includes one or more Restrictions, these must be applied to the Universe *before* the Set-Name is worked out. If there are two or more Restrictions, they may be applied to the Universe in any order.

Comments

(a) Unlike *Equations*, the Solution-writer must *not* write = Goal after the Set-Name.

(b) Mid/Jr/Sr: With the Absolute Value variation (see Section **XIII** below), the Goal may have more than one value. Then any Solution must equal one of the legal values of the Goal.

4. The Solution uses the cubes correctly.

a. The Solution contains at least *two* cubes.

Example In Middle, Junior and Senior Divisions, the following Solution satisfies this rule:

Restriction: B = B
Set-Name: B

The Solution contains three cubes even though the Set-Name contains only one.

b. Every cube in Required is used in the Restriction part (if there is one). These same cubes (except any = or <u>C</u>) must also be used in the Set-Name.

c. Each cube in Permitted may be used in the Restriction part (if there is one). These same cubes (except any = or <u>C</u>) may also be used in the Set-Name.

d. The Solution uses *no* cube in Forbidden.

Comment Since several Resource cubes may show the same symbol, it is possible to have a U in Forbidden that *must not* be used in the Solution at the same time that there is a U in Required that *must* be used.

e. After a Now challenge, the Solution must contain *at most one* cube from Resources.

f. After an Impossible challenge, any cubes in Resources are considered to be in Permitted and therefore may be used in the Solution.

5. In Adventurous On-Sets, the Solution satisfies all conditions imposed by the variations selected for that shake. (See Section **XIII** for the list of variations.)

Examples

(a) If the variation "– Required" has been chosen, each Solution must contain a – sign.

(b) If the Two Operations variation has been chosen, then the Set-Name part of every Solution must contain at least two operation symbols.

6. Every legal interpretation of the Solution equals the Goal.

    a. An *ambiguous Solution* is one that has more than one legal interpretation. Such a Solution is incorrect if an opponent shows that one of the interpretations does not equal the Goal.

    b. The only defined order of operations in On-Sets is that the ' operation takes priority over all other operations (U, ∩, –, and special operations defined by variations). Consequently, a Solution may be ambiguous if the writer does not use parentheses (or other symbols of grouping such as brackets or braces) to indicate the order of operations. ' is a unary operation, therefore, a player may not insert parenthesis to split a ' from a Set-Name.

C. After the time for writing Solutions has expired, each Solution that is presented must be checked for correctness.

    1. After a challenge in a three-player match (and before any Solution is presented), the Third Party must indicate by the end of the two minutes for writing Solutions whether he is presenting a Solution.

    Comment   To indicate his intention on the challenge, the Third Party may

    (a) state whether or not he will present a Solution;
    (b) indicate which party, Mover or Challenger, the Third Party is "joining" (agreeing with) on the challenge. This can be done verbally or by pointing to the party.
    (c) present or not present a Solution when the time limit for writing Solutions expires.

    In any case, the Third Party may not retract his decision once he has indicated whether or not he will present a Solution.

    2. All Solutions must be presented before any is checked.

        a. Once a player presents a Solution to the opponent(s), she may make no further corrections or additions even if the time for writing Solutions has not expired.
        b. Each Solution-writer must indicate the Solution to be checked. A writer who forgets to indicate the Solution must do so when asked.

    3. Opponents have two minutes to check each Solution. When more than one Solution must be checked, they may be checked in any order. In a three-player match, *both* opponents must check a player's Solution during the *same* two minutes. No other Solution should be checked during this time.

    Comment   When both players in a two-way match present Solutions after the last cube has been moved (see Section **VIII** below), only one Solution should be checked at a time.

    4. Within the time for checking a Solution, opponents must accept or reject the Solution. If the Solution is rejected, an opponent must show that it violates at least one of the criteria in Section **VII-B**. A Solution is correct if no opponent shows that it is incorrect.

    After a challenge in a three-player match, a player who does not present a Solution for a shake scores 2 if he accepts another player's Solution as correct even if that Solution is subsequently proven wrong by the other checker.

    Comment   Players must not physically move the cubes in Required, Permitted and Resources to form the Solution since this causes arguments over where each cube was played.

    5. A player who claims an opponent's Solution does not equal the Goal must give at least one of the following reasons:

a. The Goal has no legal interpretation.

Examples

   (a) The Goal is in the shape of a backwards L, which is not a legal configuration.

   (b) The Goal equals a negative number.

b. The Solution equals a value that is not a legal value of the Goal. (The only time when the Goal might have more than one value would be in Mid/Jr/Sr when the Absolute Value variation is in effect – see Section **XIIIB**.)

   (i) Checkers must make an effort to determine whether the Solution equals the Goal before rejecting the Solution. This can usually be done by applying the Solution to the Universe and turning over cards (if they disobey the Restriction) and/or selecting out the cards that are included in the Set-Name.

   (ii) The checker can give a general argument that the Solution does not equal the Goal.

   Examples

   (a) The Goal is 0, and the Solution clearly does not give the null set.
   (b) Mid/Jr/Sr: The Goal is 5, and the Restriction removes all but 4 (or fewer) cards in the Universe (with no Double Set in Jr/Sr).

c. The Solution may be grouped so that it does not equal any value of the Goal. If an opponent believes there is an interpretation of a Solution that does not equal the Goal, that opponent must copy the Solution on his paper and add symbols of grouping to create a *wrong* interpretation. If this revised Solution does not equal the Goal, the Solution is incorrect. However, each checker has only *one* opportunity to prove ambiguity. If there is a second checker, the checkers may either work together to prove ambiguity or work separately. If working separately, the second checker may simultaneously and independently try to prove ambiguity. When both checkers are ready (or one is ready and the other has nothing to show), follow the same procedure used for checking the original Solution. That is, each attempt at proving ambiguity is checked. If either shows a legal interpretation of the Solution such that the Solution does not equal the Goal, then the original Solution is incorrect. If each attempt at proving ambiguity fails, the Solution must be accepted as correct. That is, once the Solution-writer starts checking the attempt(s) at proving ambiguity, no further objections to the Equation are allowed.

Comments

(a) In the case where the checkers work separately to prove ambiguity, if the time for checking the Solution runs out, either or both checkers may take an additional minute (paying the one-point penalty to do so). If only one checker wishes to take the additional minute, the other checker may make no further changes to his revision of the Solution. If he tries to do so, then he incurs the one-point penalty also.

(b) Just as two players writing Solutions after a challenge or forceout may not communicate with each other, so two checkers attempting to prove ambiguity separately may not communicate while doing so.

(c) Each checker working separately has only one opportunity to prove ambiguity. Similarly, checkers working together have just one joint chance to prove ambiguity.

(d) While only one checker is attempting to prove ambiguity, the other checker may continue to check other aspects of the Solution.

(e) If each checker separately trying to prove ambiguity is ready with his revision of the Solution before the time for checking expires, no -1 penalty is enforced during the time the original Solution-writer checks any attempts at proving ambiguity.

(a) The Set-Name B U G – R is ambiguous and may be interpreted by an opponent as (B U G) – R or as B U (G – R). If the interpretation the opponent selects does not equal the Goal, the Solution is incorrect.

(b) R U G' is *not* ambiguous. It must be interpreted as R U (G') since ' takes priority over U.

Comment Some variations (such as Y Wild) allow certain cubes to be used for other symbols. If a Solution-writer wishes a cube to stand for anything other than what is on the cube, she must indicate clearly and unambiguously in writing what each such cube represents. (See Appendix **A** for a list of suggested ways of doing this.)

d. A symbol or group of symbols in the Solution has no defined meaning.

Examples

(a) The Set-Name is R U 'B or R ∧ G.

(b) Mid/Jr/Sr: The Restriction is R U (B = G) – R.

e. A variation is applied wrongly or not at all.

Examples

(a) With – Wild, a Solution uses a – for one symbol and another – for a different symbol.

(b) With Two Operations, the Solution contains only one operation.

VIII. Last Cube Procedure

A. If one cube remains in Resources, the next Mover must either play that cube to Required or Permitted or challenge Impossible. When the cube has been moved, each player has two minutes to write a Solution.

The last cube in Resources may *not* be moved to Forbidden. If a player does so, any challenge that is made is set aside and the cube is returned to Resources. There is no penalty unless the player's time to move expires. (See Section **XI**.)

B. An opponent may challenge Impossible against the player who moved the last cube from Resources to Required or Permitted, provided the challenge is made by the end of the first minute for writing Solutions. If the challenge is made, the Mover (and the Third Party, if siding with the Mover) has the rest of the original two minutes to write a Solution.

Comment Any Now challenge against the player moving the last cube is invalid as is any Impossible challenge made after the first minute for writing Solutions. In both cases, the challenge is set aside. A player challenging Now in this case receives a one point penalty.

IX. Illegal Procedures

A. Any action that violates a procedural rule is an *illegal procedure*. A player charging illegal procedure must specify clearly (within 15 seconds) the exact nature of the illegal procedure.

1. If a move *is* an illegal procedure, the Mover must return any illegally moved cube(s) to their previous position (usually Resources) and, if necessary, make another move.

The Mover must be given at least 10 seconds to make this correction, unless the original move was made after the 10-second countdown (see Section **XI-A-3** below), in which case the time-limit rule (Section **XI-A**) is enforced. In general, there is no direct penalty except that the Mover may lose a point if she does not legally complete her turn during the time limit.

Examples of illegal procedures

Moving out of turn, moving two cubes without calling "Bonus" before the first cube touches the mat in Forbidden, moving the last cube in Resources to Forbidden, or (in Middle, Junior and Senior) moving = or C̲ to Forbidden with more than four cubes left in Resources.

2. If the move is *not* an illegal procedure, the cube stands as played.

Comment   There is no penalty for erroneously charging illegal procedure. However, see Section **C** below if a player does so frequently.

B. An illegal procedure is *insulated* by a legal action (for example, a move or challenge) by another player so that, if the illegal procedure is not corrected before another player takes a legitimate action, it stands as completed.

Example   Suppose the player in the lead makes a bonus move. Before anyone notices the illegal procedure, the next mover moves (or a valid challenge is issued). Then the illegal bonus move stays in Forbidden without penalty.

C. Certain forms of behavior interfere with play and annoy or intimidate opponents. If a player is guilty of such conduct, a judge will warn the player to discontinue the offensive behavior. Thereafter during that round or subsequent rounds, if the player again behaves in an offensive manner, the player may be penalized one point for each violation after the warning. Flagrant misconduct or continued misbehavior may cause the player's disqualification for that round or all subsequent rounds. Judges may even decide to have the other two opponents replay one or more shakes or the entire round because play was so disrupted by the third party. In some cases, judges may order the shake replayed by all three players.

Examples   This rule applies to use of a cell phone, constant talking, tapping on the table, humming or singing, loud or rude language, keeping a hand or finger over or next to the challenge block, making numerous false accusations of illegal procedure, and so on. It also includes not playing to win but rather trying only to ruin the perfect scores of one or both opponents (for example, by erroneously challenging Now or Impossible at or near the beginning of each shake so that both opponents will score 5 for the round), saying one variation but circling another, constantly charging illegal procedure erroneously, counting down the 10-second warning in an obnoxious manner, etc.

X.   Scoring a Shake

A. After a challenge, a player is *correct* according to the following criteria.

  1. That player had to write a Solution and did so correctly.

   If the Third Party agrees with the person who must write a Solution, the Third Party must write a correct Solution also.

  2. That player did not have to write a Solution (someone else did), and no opponent wrote a correct Solution.

B. After a challenge, points are awarded as follows.

  1. Any player who is not correct scores 2.

  2. Any player who is correct scores 6, unless that player is the Third Party agreeing with the Challenger, in which case the score is 4.

C. After the last cube from Resources is moved to the playing mat and no one challenges Impossible, points are awarded as follows:

  1. Any player who writes a correct Solution scores 4.

  2. Any player who does not write a correct Solution scores 2.

D. A player who is absent for a shake scores 0 for that shake.

XI.   Time Limits

A. Each task a player must complete has a specific time limit (listed below). The one- and two-minute time limits are enforced with the timer. If a player fails to meet a deadline, he loses one point and has one more minute to complete the task. If he is not finished at the end of this additional minute, he loses his turn or is not allowed to complete the task.

Note: In Elementary and Middle Divisions, each one-point penalty must be approved by a judge initialing the scoresheet.

1. The time limits are as follows:

a.	rolling the cubes and setting the Universe	1 minute
b.	making a variation selection	15 seconds

   This time limit does not begin until after the one minute for rolling the cubes and setting the Universe.

c.	setting the Goal	2 minutes
d.	first turn of the player to the left of the Goal-setter	2 minutes
e.	all other regular turns (including any bonus moves)	1 minute
f.	stating a valid challenge after picking up the challenge block	15 seconds
g.	deciding whether to challenge Impossible when no more cubes remain in Resources	1 minute

   If the Impossible challenge is made, any time (up to a minute) the Challenger took deciding to challenge counts as part of the two minutes for writing a Solution.

h.	writing a Solution	2 minutes

   During this time, the Third Party (if there is one) must decide whether to present a Solution after a Now or an Impossible challenge. At the end of these two minutes they must present their Solution.

i.	deciding whether an opponent's Solution is correct	2 minutes

2. Often a player completes a task before the time limit expires. When sand remains in the timer from the previous time limit, the next player will receive additional time. An opponent timing the next player may either flip or not flip the timer so as to give the opponent the lesser amount of time before the remaining sand runs out and the next time limit can be started.

3. If a player does not complete a task before sand runs out for the time limit, she must be warned that time is up. An opponent must then count down 10 seconds loud enough for the opponent to hear. The one-point penalty for exceeding a time limit can be imposed only if the player does not complete the required task by the end of the countdown.

   The countdown must be done at a reasonable pace; for example, "1,010; 1,009; 1,008…,"

   An exception to this rule occurs when a player picks up the Challenge Block but does not state a valid challenge within the 15-second time limit. If the player does not wish to challenge, he loses one point and play continues.

B. A round lasts a specified amount of time (usually 30 minutes). When that time is up, players are told not to start any more shakes.

Players have five minutes to finish the last shake. After these five minutes, players still involved in a shake in which no challenge has been made and one or more cubes remain in Resources will be told: "Stop, don't move another cube — this is the end of the round. Each player has two minutes to write a correct Solution that may use any of the cubes remaining in Resources. Any player who presents a correct Solution scores 4 points for that shake; an incorrect Solution scores 2."

XII. Scoring a Match

A. Each player is awarded points for the match based on the sum of his scores for

the shakes played during that match according to the following tables:

Three-Player Matches	Points
first place	6
two-way tie for first	5
three-way tie for first	4
second place	4
tie for second	3
third place	2

Two-Player Matches	Points
first place	6
two-way tie for first	5
three-way tie for first	4

B. When a round ends, each player must sign (or initial) the scoresheet and the winner (or one of those tied for first) turns it in. If a player signs or initials a scoresheet on which his score is listed incorrectly and there is evidence that there was intent to deceive and the error was not a simple oversight, then do the following:

1. If the error gives the player a lower score, he receives the lower score.
2. If the error gives the player a higher score, he receives 0 for that round.

XIII. Adventurous Variations

A. Elementary Variations (grade **6** and below)

1. Required Cube The Solution must contain a _____ cube. The player selecting this variation specifies which non-digit symbol from the Resources fills the blank in the previous sentence.

> *Comment*   If, say, Required – is chosen along with B Wild, a B cube used as – does *not* satisfy the Required Cube variation.

2. Wild Cube The __cube may represent any symbol on the cubes except a digit. The _ cube must stand for the same symbol everywhere it occurs in the Solution. The player selecting this variation specifies which cube from the Resources is wild. The wild cube may not be a digit. Each Solution-writer must specify in writing the interpretation of the wild cube if it stands for anything other than itself in his Solution.

> *Comments*
> **(a)** If both B Wild and B Required are chosen, a B *cube* must be in the Solution but may stand for another symbol.
> **(b)** See Appendix **A** for examples of ways to indicate what a wild cube stands for in a Solution. However, if B is wild but used as B, this need not be indicated.

3. U and ∩ Interchangeable Any U may represent U or ∩, and any ∩ may represent ∩ or U.

> *Comments*
> **(a)** U and ∩ need not be used consistently. In a Solution, one U (or ∩) may be used as U and another U (or ∩) used as ∩.
> **(b)** Any wild cube used as U or ∩ gains the full interchangeable power granted U and ∩ by this variation.
> **(c)** If U (or ∩) Wild and U-∩ Interchangeable are both chosen for a shake, then, if U (or ∩) is used just for itself or ∩, it need not be used consistently. However, if U (or ∩) is used for any symbol other than U or ∩, then it must represent that same symbol throughout the Solution.
> **(d)** Since this variation makes U and ∩ "wild" in only a limited way, players are *not* required to indicate in writing where in the Solution a U stands for ∩ or a ∩ stands for U. They should simply write the symbol they want mathematically.
> **(e)** If U Wild is also called, this does not mean ∩ cubes are wild and vice-versa.

4. V and Λ Interchangeable Any V may represent V or Λ, and any Λ may represent Λ or V.

> *Comment*   The comments above for U and ∩ Interchangeable, substituting V for U and Λ for ∩, apply here.

5. Two Operations Each Solution must contain at least two operation symbols. The operation symbols are U, ∩, –, and '.

> *Comments*
> **(a)** If a wild cube is also chosen, a wild cube used as an operation counts as an operation *symbol*. On the other hand, any wild operation cube not used as an operation does *not* count as an operation symbol.
> **(b)** A Solution like R U B U V satisfies this variation. The variation does not require two *different* operation symbols in the Solution.

6. Multiple Operations Every operation sign in Required, Permitted, or Resources may be used multiple times in any Solution.

> *Comments*
> **(a)** After an Impossible challenge, any operation sign in Resources may be used many times in any Solution. After a Now challenge, if the one cube allowed from Resources is an operation cube (or a wild cube used as an operation), it may be used multiple times.
> **(b)** With this variation, an operation cube is not used to represent another symbol. So, players may simply write an operation sign multiple times in Solutions without any additional comment.

7. Shift from Permitted On your turn, you may transfer a cube in Permitted to either

Required or Forbidden. This move takes the place of your regular move.

Comments

(a) If not in the lead, you may make a bonus move from Resources to Forbidden before transferring a cube out of Permitted as your regular move.

(b) You may *never* shift a cube from Permitted to Forbidden as a Bonus move.

(c) Once the last cube in Resources has been moved to Required or Permitted, no more cubes from Permitted may be shifted.

B. Middle Variations (grade 8 and below)

1. <u>Required Cube</u> The Solution must contain a _____ cube. The player selecting this variation specifies which non-digit symbol from the Resources fills the blank in the previous sentence.

Comment

(a) If, say, Required – is chosen along with B Wild, a B cube used as – does *not* satisfy the Required Cube variation.

(b) If a player selects = or <u>C</u> Required, this variation is satisfied by using the required cube in a Restriction. If the required cube is a color, V or Λ, or an operation symbol, the variation is satisfied by using that symbol in *either* a Restriction or the Set-Name. However, in the latter case, if the required symbol is played to Required, then, as usual, it must be in *both* a Restriction (if one is made) and the Set-Name.

2. <u>Wild Cube</u> The __ cube may represent any symbol on the cubes except a digit. The _ cube must stand for the same symbol everywhere it occurs in the Solution. The player selecting this variation specifies which cube from the Resources is wild. The wild cube may not be a digit. Each Solution-writer must specify in writing the interpretation of the wild cube if it stands for anything other than itself in his Solution.

Comments

(a) If both B Wild and B Required are chosen, a B *cube* must be in the Solution but may stand for another symbol.

(b) See Appendix **A** for examples of ways to indicate what a wild cube stands for in a Solution. However, if B is wild but used as B, this need not be indicated.

3. <u>U and ∩ Interchangeable</u> Any U may represent U or ∩, and any ∩ may represent ∩ or U.

Comments

(a) U and ∩ need not be used consistently. In a Solution, one U (or ∩) may be used as U and another U (or ∩) used as ∩.

(b) Any wild cube used as U or ∩ gains the full interchangeable power granted U and ∩ by this variation.

(c) If U (or ∩) Wild and U-∩ Interchangeable are both chosen for a shake, then, if U (or ∩) is used just for itself or ∩, it need not be used consistently. However, if U (or ∩) is used for any symbol other than U or ∩, then it must represent that same symbol throughout the Solution.

(d) Since this variation makes U and ∩ "wild" in only a limited way, players are *not* required to indicate in writing where in the Solution a U stands for ∩ or a ∩ stands for U. They should simply write the symbol they want mathematically.

(e) If U Wild is also called, this does not mean ∩ cubes are wild and vice-versa.

4. <u>V and Λ Interchangeable</u> Any V may represent V or Λ, and any Λ may represent Λ or V.

Comment   The comments above for U and ∩ Interchangeable, substituting V for U and Λ for ∩, apply here.

5. <u>Two Operations</u> Each Solution must contain at least two operation symbols. The operation symbols are U, ∩, –, and '.

Comments

(a) If a wild cube is also chosen, a wild cube used as an operation counts as an operation *symbol*. On the other hand, any wild operation cube not used as an operation does *not* count as an

operation symbol.

(b) A Solution like R U B U V satisfies this variation. The variation does not require two *different* operation symbols in the Solution.

6. <u>Multiple Operations</u> Every operation sign in Required, Permitted, or Resources may be used multiple times in any Solution.

Comments

(a) After an Impossible challenge, any operation sign in Resources may be used many times in any Solution. After a Now challenge, if the one cube allowed from Resources is an operation cube (or a wild cube used as an operation), it may be used multiple times.

(b) With this variation, an operation cube is not used to represent another symbol. So players may simply write an operation sign multiple times in Solutions without any additional comment.

7. <u>Shift from Permitted</u> On your turn, you may transfer a cube in Permitted to either Required or Forbidden. This move takes the place of your regular move.

Comments

(a) If not in the lead, you may make a bonus move from Resources to Forbidden before transferring a cube out of Permitted as your regular move.

(b) You may *never* shift a cube from Permitted to Forbidden as a Bonus move.

(c) Once the last cube in Resources has been moved to Required or Permitted, no more cubes from Permitted may be shifted.

(d) You may never shift an = or <u>C</u> cube from Permitted to Forbidden (even when there are four or fewer cubes in Resources).

8. <u>No Null Restrictions</u> Each Restriction must remove at least one card from the Universe. In a chain Restriction, this variation is satisfied if any part of the chain removes a card.

Comment If a Solution includes more than one Restriction, each must remove at least one card regardless of the order in which they are applied to the Universe.

9. <u>Absolute Value</u> Any upside-down cube(s) in the Goal may be interpreted as right-side-up by a Solution-writer.

Examples

(a) The Goal 3⊂ (upside-down 2) may be interpreted as 1 or 5.

(b) The Goal $\begin{smallmatrix}3\\ \text{⊂ }\end{smallmatrix}$ (where the 2 and 1 are upside-down) may equal 5 or 7. The 2 *must* be interpreted as right-side up in order to create a legal (non-negative) value.

C. **Junior** Variations (grade **10** and below)

SPECIAL RULE: The following three variations are in effect for *all* shakes.

1. <u>Multiple Operations</u> Every operation sign in Required, Permitted, or Resources may be used multiple times in any Solution.

Comments

(a) After an Impossible challenge, any operation sign in Resources may be used many times in any Solution. After a Now challenge, if the one cube allowed from Resources is an operation cube (or a wild cube used as an operation), it may be used multiple times.

(b) With this variation, an operation cube is not used to represent another symbol. So, players may simply write an operation sign multiple times in Solutions without any additional comment.

2. <u>U and ∩ Interchangeable</u> Any U may represent U or ∩, and any ∩ may represent ∩ or U.

Comments

(a) U and ∩ need not be used consistently. In a Solution, one U (or ∩) may be used as U and another U (or ∩) used as ∩.

(b) Any wild cube used as U or ∩ gains the full interchangeable power granted U and ∩ by this variation.

(c) If U (or ∩) Wild and U-∩ Interchangeable are both chosen for a shake, then, if U (or ∩) is used just

for itself or ∩, it need not be used consistently. However, if U (or ∩) is used for any symbol other than U or ∩, then it must represent that same symbol throughout the Solution.

(d) Since this variation makes U and ∩ "wild" in only a limited way, players are *not* required to indicate in writing where in the Solution a U stands for ∩ or a ∩ stands for U. They should simply write the symbol they want mathematically.

(e) If U Wild is also called, this does not mean ∩ cubes are wild and vice-versa.

3. <u>V and Λ Interchangeable</u> Any V may represent V or Λ, and any Λ may represent Λ or V.

Comment The comments above for U and ∩ Interchangeable, substituting V for U and Λ for ∩, apply here.

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4. <u>Required Cube</u> The Solution must contain a _____cube. The player selecting this variation specifies which non-digit symbol from the Resources fills the blank in the previous sentence.

Comment

(c) If, say, Required – is chosen along with B Wild, a B cube used as – does *not* satisfy the Required Cube variation.

(d) If a player selects = or <u>C</u> Required, this variation is satisfied by using the required cube in a Restriction. If the required cube is a color, V or Λ, or an operation symbol, the variation is satisfied by using that symbol in *either* a Restriction or the Set-Name. However, in the latter case, if the required symbol is played to Required, then, as usual, it must be in *both* a Restriction (if one is made) and the Set-Name.

5. <u>Wild Cube</u> The __cube may represent any symbol on the cubes except a digit. The _____ cube must stand for the same symbol everywhere it occurs (Restriction(s) and Set-Name). The player selecting this variation specifies which cube from the Resources is wild. The wild cube may not be =, <u>C</u>, or a digit. Each Solution-writer must specify in writing the interpretation of the wild cube if it stands for anything other than itself in his Solution.

Comments

(a) If both B Wild and B Required are chosen, a B *cube* must be in the Solution but may stand for another symbol.

(b) See Appendix **A** for examples of ways to indicate what a wild cube stands for in a Solution. However, if B is wild but used as B, this need not be indicated.

6. <u>Two Operations</u> Each Solution must contain at least two operation symbols. The operation symbols are U, ∩, –, and '.

Comments

(a) If a wild cube is also chosen, a wild cube used as an operation counts as an operation *symbol*. On the other hand, any wild operation cube not used as an operation does *not* count as an operation symbol.

(b) A Solution like R U B U V satisfies this variation. The variation does not require two *different* operation symbols in the Solution.

7. <u>No Null Restrictions</u> Each Restriction must remove at least one card from the Universe. In a chain Restriction, this variation is satisfied if any part of the chain removes a card.

Comment If a Solution includes more than one Restriction, each must remove at least one card regardless of the order in which they are applied to the Universe.

8. <u>Shift from Permitted</u> On your turn, you may transfer a cube in Permitted to either Required or Forbidden. This move takes the place of your regular move.

Comments

(a) If not in the lead, you may make a bonus move from Resources to Forbidden before transferring a cube out of Permitted as your regular move.

(b) You may *never* shift a cube from Permitted to Forbidden as a Bonus move.

(c) Once the last cube in Resources has been moved to Required or Permitted, no more cubes from Permitted may be shifted.

(d) You may never shift an = or <u>C</u> cube from Permitted to Forbidden (even when there are four or fewer cubes in Resources).

9. <u>Double Set</u> Each card in the Universe that is contained in the ___set will count double for all Solutions. The player selecting this variation specifies which non- empty set of cards *that does not equal the Universe* counts double. The set must be named using an expression consisting of *at most four* symbols (not counting grouping symbols).

Examples

A player selecting this variation may choose to double B, R', G ∩ Y, (B – R)', V – B', and so on. Players may not Double Sets like B U R U G, Y – (B ∩ G)', B' – R', V – (R – B), and so on. Also if a player selects R – Y as the doubled set but there are no cards in R – Y, the player is penalized one point and must select another variation. Similarly, if a player selects B U R' as the Double Set and every card in the Universe is B or R', the player loses a point and must pick another variation.

Comment   In Senior Division, if a player specifies a Double Set using -, that – means regular subtraction, even if a subsequent player calls Symmetric Difference. However, if Symmetric Difference is called first, than any – in a Double Set called by a subsequent player (or the same player) means Symmetric Difference.

10. <u>Required/Forbidden Card</u> The player selecting this variation either specifies one card in the Universe that must be in the Set-Name of any Solution or specifies one card in the Universe that must *not* be in the Set-Name of any Solution.

Comments

(a) The player states the required or forbidden card orally and records the card in a blank on the variation selection sheet. For example, "BRG", "RY", "blank", and so on.

(b) If Blank Card Wild (see below) is chosen along with, say "BR forbidden," then the blank card may *not* be made the forbidden card (BR) for any Solution.

11. <u>Blank Card Wild</u> Each Solution-writer must specify in writing which colors, if any, are on the blank card.

Comments

(a) This variation may be chosen only if the blank card has been dealt.

(b) If the blank card remains blank for a Solution, the Solution-writer does not need to specify this.

(c) Suppose Double Set and Blank Card Wild are both chosen with, say, B the Double Set. If a player chooses to put a B dot on the blank card, the blank card counts double for that player's Solution.

(d) If Required Card is also chosen with the blank card required, that variation is satisfied if the blank card is in the Set-Name even if the Solution-writer puts one or more colors on the blank card.

(e) Blank Card Wild and Blank Card Forbidden are in conflict. So if Blank Card Wild is selected, a player then choosing Blank Card Forbidden is penalized one point and vice-versa.

12. <u>Absolute Value</u> Any upside-down cube(s) in the Goal may be interpreted as right-side-up by a Solution-writer.

Examples

(a) The Goal 3⅃ (upside-down 2) may be interpreted as 1 or 5.

(b) The Goal ³⅃├ (where the 2 and 1 are upside-down) may equal 5 or 7. The 2 *must* be interpreted as right-side up in order to create a legal (non-negative) value.

D. Senior Variations (grade **12** and below)

Players may choose any of the Junior variations (except for the three that are in effect for every shake) plus the following.

13. <u>Symmetric Difference</u> The – symbol means "symmetric difference": that is, *A – B* equals (*A – B*) U (*B – A*), where these last two – signs mean set subtraction.

If – Wild has already been selected for the shake, no player may select Symmetric Difference for that shake. Similarly, if Symmetric Difference has been chosen, no player may select – Wild. (In

either case, the player selecting the second of the two conflicting variations receives a -1 penalty.)

Comments

(a) If Wild Cube is also chosen, any wild cube used as – means symmetric difference, not set subtraction.

(b) In Solutions, players simply write the – sign with the understanding that it means symmetric difference.

14. <u>Two Solutions</u> Each Solution-writer must write two Solutions; the set named by the second Solution must contain at least one card that is not in the set named by the first Solution.

When this variation is in effect, players have *three* minutes to write Solutions and *three* minutes to check each player's pair of Solutions. Also no Now challenges may be made with fewer than *three* cubes left in Resources. Furthermore, when the Mover plays the last cube from Resources to Required or Permitted, the other players have *two* minutes to challenge Impossible.

Comments

(a) An Impossible challenge should be made against a Goal of 0 since it is impossible to satisfy the Two Solutions variation in this case. Similarly, a Goal equal to the number of cards in the Universe is impossible. With Double Set, the Goal can legitimately be larger than the number of cards. However, if the Goal is such that all cards in the Universe must be in any Solution, then an Impossible challenge should be made.

(b) In determining the rules a player's two Solutions must follow, it is helpful to think of the Solutions as if they were presented by *different* players. Each Solution must use the cubes correctly and obey all the variations for the shake.

(c) After a Now challenge, Solution A of a player may use one cube from Resources and Solution B of that player may use a *different* Resource cube (or no cube).

(d) A wild cube may stand for one symbol throughout one of a player's Solutions and another symbol throughout the other Solution.

(e) With Blank Card Wild, a Solution-writer may put one set of dots (or no dots) on the blank card for one Solution and another set of dots on the blank card for the other Solution. However putting a different set of dots on the blank card does not make it a different card for the second Solution. Thus, if the first Solution yields a set consisting of cards 1, 2, 3 and the blank card and the second Solution produces cards 1, 2, 3, and the blank card (with a different set of colors on it), these Solutions do not satisfy this variation. Similarly, if the Goal is 1, a player may not write one Solution that produces the blank card with a certain set of dots on it (or no dots) and a second Solution that produces the blank card with a different set of dots on it.

(f) Suppose Required Card is chosen and the Goal is 1. An opponent should challenge Impossible since it is impossible to write two Solutions that produce a different card and satisfy the Required Card variation.

(g) With Absolute Value, one Solution may equal one interpretation of the Goal, and the other Solution may equal the other interpretation.