

# Matryoshka Structure

Problem No. 4: Divisions I, II, III & IV

## A. The Problem

It's always the more the merrier with nesting dolls, also known as Matryoshka! In this problem, teams will design and build a Matryoshka Structure made of only balsa wood and glue that holds as much weight as possible. The structure will hold additional structures nested one inside the other. The more structures that are nested, the higher the score! Before weight placement can begin, the nested structures will be removed one-by-one to reveal a tiny character nested inside the smallest structure. The performance will star the tiny character and have a theme about storage that includes placing weights and the structures.

The **creative emphases** of this problem are on the performance, the way the Matryoshka Structure is designed to hold nested structures and be disassembled and reassembled, the tiny character's portrayal by a team member, and how storage and weight-placement are presented in the performance.

The **Spirit of the Problem** is for the team to design, build, and test a Matryoshka Structure—a structure with smaller versions of it nested inside. The structures must only be made of balsa wood, glue if desired, and the outer structure will be tested by placing as much weight as possible onto it. Before weight-placement begins, the assembled structures are disassembled into two interconnected parts to remove the next structure from largest to smallest until a tiny character is released. The performance will imitate the structures being removed with a team member that represents the tiny character being revealed and coming to life. It will also include storage in the theme.

## B. Limitations *(Italicized words/terms are defined in the 2021-22 Odyssey of the Mind Program Guide or the Problem Glossary.)*

1. **General Rules:** Read the *2021-22 Odyssey of the Mind Program Guide*. This manual is updated each year and includes important rules for solving the Odyssey of the Mind problems and forms required for competition. This problem cannot be solved without referring to the [Program Rules](#) section of the Program Guide.
2. **Problem Clarifications:** The *Odyssey of the Mind Program Guide* explains the types of questions that will be clarified and how to submit them. Problem clarifications can be submitted and accessed at [www.odysseyofthemind.com/clarifications](http://www.odysseyofthemind.com/clarifications). The deadline for submission is February 15, 2022. CCI may find it necessary to issue clarifications after that date, so continue to check for them after February 15 and before each competition.
3. The **time limit** for this problem is 8 minutes. This starts when the Timekeeper says, "Team Begin," and includes setup, removing the structures and tiny character, Style, the presentation of the solution and testing the structure. Time ends when the team finishes or the Timekeeper says, "Time," whichever comes first.

4. The **cost limit** for this problem is \$125 (U.S.). The combined value of all materials used during the presentation of the solution, including Style, cannot exceed this amount. The balsa wood used in the structure tested for weight held and the nested structures are exempt from cost. The Odyssey of the Mind Program Guide explains the cost limit and lists items that are exempt from cost.
5. The team's solution will be presented in an original performance that includes:
  - a. a Matryoshka Structure made of only balsa wood. Glue may be used to hold the pieces of balsa wood together.
  - b. additional structures *nested* inside the Matryoshka structure and each other.
  - c. a tiny character nested inside the smallest structure.
  - d. a team member that portrays the tiny character.
  - e. a theme that includes storage.
  - f. five Style elements including two that are chosen by the team listed in F. Style.
6. The Matryoshka Structure:
  - a. and nested structures must be made of only balsa wood and glue, if desired, that is used to connect the balsa wood.
  - b. must weigh no more than 15 grams including glue for Divisions II, III, & IV and no more than 18 grams for Division I. This does not include the nested structures and the tiny character.
  - c. will hold the smaller versions nested inside itself. Only this outer "Matryoshka Structure" will be tested for weight-held.
  - d. must be a minimum of 8" (20.32cm) in height when resting on the Tester base and supporting the Crusher Board (see Fig. B) and another weight. Extension pieces used to meet minimum height limitations but not to support weight, as determined by the judges, are not allowed.
  - e. must be a single assembled structure that is designed and built by team members without any outside influence (see B21).
  - f. may be built using other items and/or devices; however, these must be removed before the structure goes through the Weigh-In process (see C2-4).
  - g. must have an open area running the entire height that will accept a column that is 2" (5.1cm) in diameter when being used for testing. Therefore, when being tested, the opening in the structure must be greater than 2" (5.1cm). This opening will be measured at Weigh-In. The safety pipe must pass through the opening of the structure during weight placement (see Fig. A.).
  - h. must contain all the nested items and the tiny character before time begins. It will move as one when assembled and nested and must remain nested **when it is turned sideways and upside down.**
  - i. must be disassembled after time begins into two parts to remove the nested contents and then put back together for testing.
7. The balsa wood used in the structures:
  - a. must come from only commercially produced strips of balsa wood. No other type of balsa wood or any variation of balsa wood may be used. Balsa wood may be purchased through [www.odysseyofthemind.com/shop](http://www.odysseyofthemind.com/shop) — any balsa purchased from here during the current program year will be considered as being within the limitations. Teams must provide an invoice from CCI that shows the purchase information including the date of the transaction.

Balsa used in the structure does not count towards the cost limit. If balsa is used as any other part of the presentation, that balsa counts toward the overall cost.

- b. must come from strips with a cross section of 1/8" x 1/8" (0.32cm x 0.32cm) that are at least 36" (0.91m) long when the team receives it. It is not allowed to be cut by the team into strips from oversized wood (greater than 1/8" in width or depth) to meet the 1/8" (0.32cm) cross section limitation.
  - c. must have a 1/8" x 1/8" deep (0.32cm x 0.32cm) cross section for most of its length. Some commercial cuts vary, so the allowed cross section dimensions enforced will be 0.115" to 0.135" (0.29cm to 0.34cm). Any piece that does not have a cross section within 0.115" to 0.135" (0.29cm to 0.34cm) will be considered a prohibited piece. Teams are allowed to sand or carve pieces of wood in small areas to form joints as long as the cross section for the rest of its length beyond the joints is within this range.
  - d. is not allowed to be hand-picked by anyone other than team members. Team members may request wood to be from a commercially available grade, but no one else may sort and pick specific pieces.
  - e. must be cut by the team. The only exceptions are the perpendicular end cuts of the original strip as defined in B7a & b.
  - f. must be used "as is." The wood is not allowed to be strengthened in any way. Use of water or hot and/or cold air are not considered strength-enhancing.
8. If glue is used in the structures:
- a. must be a commercial brand that has the word "glue," "epoxy," "cement," or "adhesive" printed by the manufacturer on its label (container and/or packaging). More than one type of glue may be used. The container, packaging, or purchase invoice from any glue used in the structure must be brought to Weigh-In to ensure there is no penalty for a substance other than glue being used.
  - b. must be used as purchased. That is, nothing may be added to it, and it is not allowed to be mixed with anything unless the manufacturer specifies that the ingredients, sold together, combine to form the glue. Accelerants are not allowed to be used.
  - c. must only be used to adhere pieces of balsa wood together to form two single, interconnected parts.
9. Judgements dealing with measurements, weight, wood, the "open area" (see Fig. A) and artificial strengthening will take place at the Weigh-In Site before competing. Judges not associated with Weigh-In may bring certain matters to the attention of the Weigh-In Judges. Penalties may be given before and/or after a team has competed.
10. The structures nested inside the Matryoshka Structure:
- a. must be completely inside the structure to be considered *nested*. That is, a nested structure is not allowed to break the exterior plane of the structure it is nested within. For example, when a team member picks up the Matryoshka Structure and moves it to a different location while remaining in an upright position, all nested items (structures and character) will remain inside of the structure nesting it and move to the same location.
  - b. must be made of only balsa wood and glue. All rules from B7 & B8 apply to the nested structures.
  - c. will receive score for how much they look like smaller versions of the Matryoshka structure.
  - d. will be scored as follows: 1 nested = 5 pts, 2 nested = 10 pts, 3 nested = 20 pts

- e. if there are no nested structures the team will receive a score of zero for D5a and Penalty E12.
  - f. must also be able to be disassembled
11. Unnesting the structures and tiny character will take place one at a time, from largest to smallest, before weight placement can begin and will be done by the team this way:
- a. Disassemble the Matryoshka Structure into two parts.
  - b. Remove the structure inside. All other nested items must be inside the structure that is removed. The Matryoshka structure may be placed on the tester as the next steps continue.
  - c. Disassemble the structure that was removed into two parts and continue for all nested structures.
  - d. When the Tiny Character is removed from the last structure weight placement can begin.
12. The tiny character nested inside the smallest structure:
- a. must be the last item removed from the nested structures.
  - b. does not have to be made of balsa wood.
  - c. will be portrayed by a team member in the performance. As the tiny character is removed from the structure, the team member portraying the tiny character will also be revealed in the performance.
13. The performance:
- a. will mimic the nested structures being removed and the tiny character being revealed.
  - b. can have a theme about anything the team wishes, but it must include storage, the structures being revealed, and the tiny character.
14. Team members must place weights one at a time onto the structure. The first weight must be the Crusher Board supplied by the Tournament Director. This will count towards weight held.
15. Team members are required to safely select, lift, carry, and place weights onto the structure. Division I and Division II teams are not required, but are allowed, to have adult assistance in placing weights as follows:
- a. Adults are not allowed to help any team in any division select weights for placement.
  - b. Division I and II teams will determine if they will use limited adult assistance\*. They may use adult assistance at any time during weight-placement from when the weight has been selected by the team until it is resting in place on the weight stack.
  - c. Division I teams may have an adult assist at least one team member in placing weights heavier than 20 lbs.
  - d. Division II teams may have an adult assist at least one team member in placing weights heavier than 40 lbs.
  - e. The adult is only allowed to help. If the judges determine an adult is selecting a weight, or is doing more than assisting one or more team members, they will instruct the team to remove the weight and place it back onto the unused weights before continuing weight placement. If the weight would not fall to the floor if the team member were to let go, the adult is breaking the rules. There are no other constraints on adult assistance.

*\*only one adult (18 years or older) is allowed to be on the competition site and assist the team at any time. The adult is allowed to help one or more team members lift, carry, and/or place weights onto the*

*stack (per limitations). The adult is allowed to assist in placing the weights whether or not they helped carry the weight to the Tester.*

16. Team members must wear safety goggles, eyeglasses with plastic lenses, or other protective eyewear (approved by the judges) if they are within the Safety Area with their head below the level of the Crusher Board while the structure is supporting weight. This applies to everyone in the Safety Area (see E10).
17. A weight must be held on the stack for at least 3 seconds to count in the total weight-held score.
18. If the weight stack reaches the top of the safety pipe, it is the team's responsibility to add an extension pipe to the safety pipe (if provided by the Tournament Director).
19. The team should present the Staging Area with four copies of the Team List Form found in the forms section at [www.odysseyofthemind.com/members](http://www.odysseyofthemind.com/members) or four copies of a list on one side of one or two sheets of 8 ½" x 11" or A4 paper. This list can be hand-printed or computer-generated. It is for reference only. The list must include:
  - a. the team's membership name and number, the problem and division.
  - b. the number of structures nested inside the Matryoshka Structure for score.
  - c. a brief description of the tiny character and how the team member that portrays it will be revealed in the performance.
  - d. the signal the team will use to indicate it has finished its performance (weight-placement can continue if time allows).
20. The team must use only the weights and tester supplied by the tournament director. These can only be used in the normal process of placing weights; for example the weights cannot be used for style, the tester cannot be decorated, etc.
21. A reminder about Outside Assistance: All Outside Assistance rules apply. Team members are responsible for making an original design and building an original structure. Photographing or otherwise referencing other teams' solutions is Outside Assistance.

### **C. Site, Setup and Competition**

1. A stage or floor area a minimum of 14' x 14' (4.3m x 4.3m) will be used, but a larger area is desirable. This will not be marked. Teams must be prepared to perform in a 14' x 14' (4.3m x 4.3m) area. If space permits, the team may perform and/or place equipment, props, etc. outside the area. If a drop-off exists beyond the dimensions, a caution line may be taped 30" (76.2cm) from the edge of the drop-off. This will serve as a warning, not a boundary.
2. Each competition might have specific times to report to Weigh-In, but generally teams report to the Weigh-In Site with its Matryoshka Structure, nested structures, tiny character, and glue, if used, to have it checked for specifications at least 40 minutes before its scheduled performance time. The structure being tested should be brought to weigh-in without the nested structures and tiny character inside so it can be weighed. The nested structures will also be checked for appearance, and then the team can nest the structures and the tiny character to be ready for the performance to begin.

3. If the Matryoshka Structure or any nested structures do not meet specifications, Weigh-In judges will try to give the team an opportunity to bring it into specification or submit a different structure before the team's competition time. In most cases, corrections should be completed no less than 20 minutes before competition time. There is no penalty if the structure is brought into specification before completing the Weigh-In process.
4. The assembled Matryoshka Structure, with all contents removed, will be weighed and measured. The team will then nest all the structures and tiny character into the Matryoshka Structure. A judge will provide the team with a bag, or the team can use its own container if it is approved by the Weigh-In officials to store the Matryoshka Structure. The team will place the structure into the bag/container and the judge will attach a Weigh-In Checklist to it. The structure will remain at the Weigh-In Site until the team picks it up for competition. The team must return to pick up its structure no later than 25 minutes before its scheduled competition time.
5. Team members must report to the competition site with everything they will use in their solution at least 20 minutes before they are scheduled to compete. The team is not allowed to remove the Weigh-In Checklist until directed to do so by the Staging Area Judge. If the Weigh-In Checklist has been removed, the bag or container tampered with, or the structure removed, the team may have to repeat the Weigh-In process. Depending on the situation, the team could receive a Spirit of the Problem penalty.
6. The team should inform the Staging Area judge if it expects to continue its performance after the structure breaks. Should the team finish its performance before the structure breaks and has given the signal to end the performance, the team will be allowed to continue placing weights until any one of the criteria from C10 or C13 occurs.
7. Teams should bring cleaning utensils to clean up any mess. Should a team take an unreasonable amount of time to clean the site, or leave a mess, the judges will assess an Unsportsmanlike Conduct penalty. Others not on the team's roster may help the team clear the site and remove the team's props. The competition area must be left clean and dry for the next competing team.
8. A three-prong electrical outlet will be available at the performance area. Teams must bring their own extension cords and adapters, if needed.
9. If possible, the Tester will be on a solid, level floor. The Tester will be positioned in the center of a Safety Area, a 60" x 60" (1.5m x 1.5m) taped square, which will serve as a guide so team members are aware of their proximity to the Tester and as a reminder of where they must wear safety glasses. The team is not allowed to move the Tester.
10. The team has 8 minutes to test its structure and present its performance. The team must stop all activity when the judge calls "time." Or, the team may give a signal indicating the performance portion is over.
11. The nested structures and Tiny Character must be unnested before weight-placement can begin. Time will continue.

12. The team is allowed to touch and adjust the structure while placing the Crusher Board on it and while placing the first weight onto the Crusher Board. They are not allowed to touch the structure once the team begins to place weights onto the Crusher Board. If the team wishes to adjust the structure, they must remove all weights. They are allowed to remove the Crusher Board, but it is not required. Team members may then touch the structure before resuming weight placement.
13. If any of the following occur, all weight-placement will end when:
  - a. the Crusher Board or any part of the structure touches any corner post.
  - b. any part of the structure touches anything other than the surface of the Tester base and the bottom of the Crusher Board.
  - c. the top weight rests against the safety pipe and the judges determine that the pipe is helping to support the weight stack. If time remains, the team will be given the opportunity to adjust that weight and continue weight placement.
  - d. a weight extends beyond the height of the full length of the safety pipe, including extension pipes, if provided by the tournament director.
  - e. the team indicates it wishes weight placement to stop.

#### **D. Scoring**

1. Overall creativity of the performance .....1 to 15 points
2. Overall quality of the presentation .....1 to 10 points
3. Weight Held (calculated based on the most weight held in that competition).....1 to 100 points  
*In each division, the team with the highest weight-held score will receive 100 points. All other structures will receive a corresponding score based on the percentage of weight held.)*
4. The Matryoshka Structure.....3 to 25 points
  - a. ...is disassembled into two parts and reassembled into one .....0 or 10 points
  - b. ...creativity of its design .....3 to 15 points
5. The nested structures inside the Matryoshka Structure.....0 to 25 points
  - a. 1 nested = 5 pts, 2 nested = 10 pts, 3 nested = 20 pts.....0, 5, 10 or 20 points
  - b. look like smaller versions of the Matryoshka Structure.....0 or 5 points
6. The Tiny Character is the final item nested within the smallest structure ..... 0 or 5 points
7. The team member representing the tiny character .....1 to 10 points
  - a. is revealed when the Tiny Character object is released .....0 or 5 points
  - b. Impact of the Tiny Character’s portrayal in the performance ..... 1 to 5 points
8. How storage and weight placement are integrated in the theme .....1 to 10 points
  - a. ...Includes storage in the theme.....0 or 5 points
  - b. ...Creativity of how storage and weight placement are presented ..... 1 to 5 points

*Maximum possible: 200 points*

## E. Penalties

1. Spirit of the Problem violation (each offense).....-1 to -30 points
2. Unsportsmanlike conduct (each offense) .....-1 to -30 points
3. Missing membership sign or wrong team/problem/division .....-1 to -5 points
4. Outside assistance (each offense) .....-1 to -25 points
5. Having someone other than team members cut pieces of wood, apply glue, or work on the structure in any way .....weight-held score of zero
6. Over cost limit.....-1 to -30 points
7. Artificially strengthened structure .....-5 points to weight-held score of zero
8. Structure does not meet specifications and is not corrected before completing Weigh-In\*:
  - a. Overweight structure (Weight will be determined by the official gram scale for each competition.): Any structure weighing more than 15 grams (18 grams for Div. I) will receive -5 points for every 0.1 gram overweight up to 2 grams. Two or more grams overweight will receive zero score for weight-held. The penalty must not exceed the calculated weight-held score.
  - b. Undersized or Oversized Wood per B7c .....weight-held score of zero  
*(Not assessed if it is an irregularity of that piece and the rest is within limitations)*
  - c. Undersized Structure:
    - (1) Less than 8" (20.32cm) but more than 7-7/8" (20cm) high.....- 50 points
    - (2) 7-7/8" (20cm) or less.....weight-held score of zero
9. Open area does not accept the 2" (5.1cm) diameter column through its entire height.....weight-held score of zero
10. If any team member is not wearing safety glasses while inside the Safety Area with their head below the Crusher Board, the team must stop weight placement until that team member puts on safety glasses. Time will continue.
11. If an adult selects a weight or places it without direction and help from a team member, that weight does not count toward weight-held score. The weight must be removed. It may be placed again properly for score. A judge will warn the team and the adult. If this continues after two warnings, a 10-point Outside Assistance penalty will be assessed for each future occurrence.
12. Zero nested structures.....zero score for D5a and -15 points Spirit of the Problem Penalty  
*\*These penalties will be substituted with a weight-held score of zero if, in the aggregate, that is less of a penalty. Teams that don't present a scored element of the problem (see D. Scoring) will not receive a penalty; they will receive a zero score for that category, except for having zero nested structures.*

**F. Style** (Elaboration of the problem solution; use four copies of the Style Form from the 2021-22 Odyssey of the Mind Program Guide.)

1. Creative use of a trash item in a backdrop or prop .....1 to 10 points
2. Effectiveness of the way a character other than the Tiny Character moves ..... 1 to 10 points
3. (Free choice of team).....1 to 10 points
4. (Free choice of team).....1 to 10 points
5. Overall effect of the four Style elements in the performance .....1 to 10 points

*Maximum possible: 50 points*

## **G. Tournament Director Will Provide**

1. At the Weigh-In Site:
  - a. a gram scale accurate to 1/10th of a gram.
  - b. a micrometer or other precision method of checking wood thickness.
  - c. an accurate ruler or device to measure the structure's size requirements.
  - d. a 2" (5.1 cm) diameter column-measuring device.
  - e. a bag to hold the team's assembled structure.
  - f. tape to attach the Weigh-In Checklist to the bag.
2. At each competition site:
  - a. a 14' x 14' (4.3m x 4.3m) competition area (larger if possible) with a taped safety area.
  - b. a three-prong electrical outlet reaching the performance area.
  - c. a Tester and a 60" x 60" (1.5m x 1.5m) taped Safety Area.
  - d. a 12" (30.48cm) extension to the safety pipe (if available).
  - e. three pairs of safety glasses: one to be used by a judge and two that are available to the team.
  - f. a judging team and all materials necessary to judge this problem.
  - g. a minimum of 400 lbs. of weights in assorted sizes, generally from 5 lbs. to 45 lbs. (2.28kg to 20.41kg), each with a hole 2" (5.1cm) in diameter. When registering for a tournament, teams needing more weight should notify the Tournament Director. Teams are not allowed to bring and use their own weights.

**Note:** *Contact your Tournament Director for information regarding specific competition sites such as actual dimensions, amount and size of weights, weight of the Crusher Board, registration procedures, floor surface, etc. Do not submit a clarification request for this information.*

## **H. The Team Must Provide** *(Additional requirements might be necessary depending on the format of the competition.)*

1. Four copies of its Style Form, one Cost Form, one Outside Assistance Form, and all of its team clarifications.
2. Four copies of the Team List. This list is to assist the judges. If the team fails to provide the list, there will be no penalty; however, it benefits the team to have the lists because without them the judges might miss a scored aspect of the performance.
3. Safety glasses or other eye protection. However, the team may use up to two pairs of goggles provided by the Tournament Director.

4. Any necessary extension cords or adapters.
5. Cleanup materials as needed.

## I. Metric Equivalency Chart

Lengths:

1 inch = 2.54 cm            1 foot = 30.48 cm

1 cm = .39 inches        1 meter = 3.28 feet

Weights:

1 ounce = 28.35 grams   1 gram = .035 ounces

1 pound = .45 kilograms   1 kilogram = 2.2 pounds

**J. Problem Glossary** (Italicized terms that are not in this Glossary can be found in the 2021-22 Odyssey of the Mind Program Guide)

***Interconnected*** - parts must be connected and not simply be touching. Touching alone is not considered interconnected.

***Assembled*** - No more than two separate interconnected structure parts, reassembled into one structure. When assembled into one single structure and held at any point of contact, may be lifted straight up, moved to another location, placed back down, and remain connected as a single assembled structure. Pieces may change their orientation or position but they must be able to move as one unit.

***Nested*** - A set or series of similar things, each fitting completely within another version the next size larger.

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## PRECAUTIONS

- Use eye protection, e.g., a face shield, safety glasses, goggles, etc., when looking closely at a structure holding weight. Collapsing structures may project pieces of wood several feet.
- Keep your fingers on the sides of the weights when placing them onto the Crusher Board or onto other weights.
- Remain aware of the structure, the testing device, and the weight stack at all times to avoid injury in case of collapse.

- Do not stand too close to the structure, Tester, and weight stack unless necessary, and avoid bumping them accidentally.
- Use a safety pipe through the center hole of the weights to help prevent them from falling.
- Place a piece of plywood/hardboard or a tumbling mat under weights waiting to be placed onto the weight stack to help prevent damage to the floor.
- Super glues are extremely dangerous to use and some glues have dangerous fumes. Read and follow all precautions and directions on the manufacturer's labels. Non-toxic model airplane wood glues are recommended. If toxic glue is used, proper precautions, such as adequate ventilation and parental supervision, are advised.