



Updates bolded

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The Big Picture

In Science Olympiad, the primary goal of every event is to have the teams correctly ranked by their relative skill levels. This means that you want to reduce any randomness in the results. Equally, remember that your competitors are middle schoolers without adult knowledge and skills. This is an event to learn basic map skills that are not available in the standard middle school curriculum.

If this is your first time running an event, it can be pretty scary. There are a lot of experienced event supervisors out there and almost all of them will be happy to help you get started. If you don't know any, ask the tournament director to put you in touch with one. Even if they have not done Road Scholar, most experienced event supervisors can be a big help. If you are not familiar with Road Scholar at all (not a coach), you really need to get paired with at least an experienced Road Scholar coach. The situation of a new event supervisor without any serious experience in the event can happen very easily, particularly at invitationals where they are drafting event supervisors.

Technique 1: Reading Event Rules

Let's start with the event rules. You need to be familiar with the current version of the rules. Road Scholar rules changed in **2024-25** minimally. **The changes include moving topographic map profiles (para 3. a. xiv) back to all tournaments and a word change to paragraph 3. a. vii. In addition, the sample questions were removed and are located on the Road Scholar Event page at soinc.org.**

Like all Science Olympiad rules, there are a lot of options available to an event supervisor. There are key things about the rules you should keep in mind. Road Scholar is mainly focused on using map reading and math skills to solve problems and less about memorization and identification. There is both broad latitude for an event supervisor and restrictions on what can be asked. Please look the various sections over carefully. We'll take a quick tour of each section.

Section 1 is the big picture. The phrase "interpretive questions" is intended to highlight using skills more than memorization and identification.

Section 2 is about the preparation both event supervisors and students should have and do before they enter the room. Please note that competitors in Road Scholar are not required to use a container. Some teams will be able to bring their information and equipment in their hands without making a mess. Also, note that the rules allow the use of pre-2010 and post 2010 topographic maps and their associated symbol sheets.

Please pay special attention to the accuracy check requirement for event supervisors (2.b.). Many copying and printing operations can subtly, or not so subtly, change the dimensions of the objects. All questions that require measurements should be checked on the actual papers or maps the students will be using in the test and the answer key adjusted as needed. NEVER assume that printed or reproduced papers are exactly the same as the source material.

Experienced event supervisors are also prepared for students without pencils. Some may not have protractors or rulers. Since, they can't leave the room and return once the test has started, a spare available for borrowing is a nice gesture. Also, a box of tissues in the runny nose season is always a good idea.

Section 3 is the heart of the test. The map draw portion (3. c. "Student-Created Map") must be a one-mile square (PLSS section) per paragraph 2. b. The topographic profile should include at least the requisite number of lines of the appropriate length. More is OK, but too few or too short should be avoided. Please note that aerial/satellite photos

must be in the visible light spectrum. Remote Sensing in Division C will expose competitors to imagery from other electromagnetic spectra.

In the detailed testing areas, paragraph 3. a. vii. is oriented toward asking questions around areas that could be affected by flooding and how to cope with those issues. Please do not go wild with complex questions. 3. a. viii. (2) refers to the sectors marked by the 2.5' tick marks on a 1:24000 topographic map, NOT PLSS sections. 3. d. iii. applies to using shadows and the photo orientation to interpret the time of day that the photo was taken. Normally, a satellite or aerial photo has north at the top, like a topo map. However, not all do or you may have rotated the photo for some reason. Students cannot accurately determine the time of day without knowing where north is. 3. d. v. is oriented primarily toward using the map information to plan a smart route. An example would be noting the one-way arrows on city streets and planning a route that you can actually drive. No wrong way violations!

The Scoring section is brief. Road Scholar questions tend to have a very wide range of degrees of difficulty. For example, consider the difference in skills required to correctly compute a latitude when compared to identifying a symbol listed in the margin data. This is the reason to weight questions differently. The weighting option exists to allow the event supervisor to create a scoring rubric that takes account of more difficult and less difficult questions.

All of the areas listed in Section 3 do not have to be tested at every level. However, the higher the tournament level (e.g., small, early season invitational versus nationals), the more testing areas should be included. National tests are typically written to have significant questions from every testing area. At invitationals that provide the tests and keys to every competitor, you may want to view your test as training tool for beginners. In that case, consider adding some unscored questions on the missing topics. To avoid confusion, maybe put the questions and answers in the key.

Technique 2: Writing the Storyline

If you choose to incorporate a storyline into your test, consider a few planning recommendations. First, remember that the test is focused on using the maps. The storyline should support the test. It may provide important information that is not in the actual questions. But it should not be so complicated that students are having to do more reading than map work. The storyline cannot be an afterthought. It needs to be a part of your planning right from the beginning. A light hand, even a little humor, is preferable. The students are already feeling a lot of pressure, a light touch helps them handle it. They also take a little longer to write. Be sure you start in enough time to do justice to both the test and the literary effort. Storylines do take some preplanning to be sure that the flow of questions is reasonable. In addition, you need to plan out a consistent approach to identifying your actual questions. The actual questions and their locations need to be obvious to the students. Highlighting, bolding (especially question numbers) and underlining can all help.

The quicker approach to a storyline is to choose your maps and use the storyline to make transitions between the questions and to provide a reasonable sequence of events. These kinds of stories can be incorporated right into the individual questions or they can be in interspersed paragraphs.

The longer approach to storylines is to plan out a detailed story you want to tell such as an informational story or a funny story and then build the test around it. This may require you to pick the story first and choose the maps after the story is roughed in. Either way, be sure the story moves along rapidly so the students can concentrate on doing the questions. Set a standard for yourself such as being sure that there are at least four or five questions per page of text to prevent a story that buries the test.

Technique 3: Designing Questions

Designing questions is a subset of the larger process of designing the test. There are several decisions that you will want to make early. The most critical decision is what your goals for the test are. Is the test primarily a teaching tool? This is a more common decision at invitationals and some regionals but is never entirely absent, even at nationals. Is the test designed to reduce ties in scoring? Is the test designed to make it a positive experience for most of the students? Is the test being designed to make it easy to score, especially if you are very pressed for time? None of these are mutually

exclusive decisions, but are considerations that will affect how you structure the test and the approach you take to questions and layout.

An early decision is whether to incorporate answers into the actual test or to use a separate answer sheet. Experience strongly indicates that separate answer sheets speed up the scoring process. Also, they reduce the number of pages that have to be reproduced. This is especially a consideration with pages that have to be color printed due to graphics that must be in color. If you have separate tests (question sheets) and answer sheets, you only need enough tests (question sheets) to cover your largest number of teams in one round plus a spare or two. You will need answer sheets for all the teams plus a spare or two. For example, a 33-team tournament with three rounds for your event means 11 teams per round. Bring 12-13 copies of the test and 34-35 copies of the answer sheets. Also, if you use separate answer sheets they are usually only one to three pages and are much easier to keep track of during the scoring process. Having said all that, answers can be on the test pages and for smaller tournaments and shorter tests, it will not make a lot of difference. Make sure regardless of the method you use, that every page with answers has a place for students to write their team name and number.

The next decision is what kind of questions to write. There are three basic types of questions: identification, analysis and computation. All tests should have a mix. Identification questions are both easiest to write and answer. Every test should have some. Use legends, marginal data, and other textual matter on the maps as well as the USGS Topographic Symbols sheet as sources. Be cautious about using identification questions that are based on information not found on the maps. Middle school students need to know more about geography than just the maps in front of them. However, they do not have sophisticated levels of understanding about many geographic and cartographic concepts and basic theories. That's what high school and college are for.

Analysis questions are based on using information on the maps or other material to identify a solution to a problem. These are questions that use information reasonably available to the student to work out an answer. An easy example is asking for the best driving route on a highway inset (city) map that has one-way streets indicated. You want a mix of relatively easy to relatively hard questions of this type. The event is focused on using maps to solve problems and analysis is the way you do that.

Finally, there should be some computational problems. These include both measurement and math. In looking at the rules, there are many areas where you can draw measurement and math problems from. Distance, slope and the four grid systems are obvious examples. Frequently, these kinds of questions can be written to incorporate some analysis. The good news is that Road Scholar as currently designed requires only the four basic arithmetic operations. Many problems can be set up as proportions and that allows the supervisor to write a variety of questions. If you have not looked at it yet, please take a look at the "Math in Road Scholar" handout on the Road Scholar Event page at soinc.org.

Please be sure that your answers require correct labels and units. This is both an educational issue and a science issue. An easy example is measured distances. They must include the correct units (e.g., miles, degrees, meters, or their symbol equivalents). They must also be appropriately labeled or identified. An obvious example is a highway number. Most states have state highways with the same numbers as US/Federal highways in the state. In some states, they may even meet. Therefore, a best answer includes the type highway (e.g., US 12 vs OH 12). Finally, many answers have specific formats. E.g., latitude and longitude have very standardized formats. Student answers should be correctly formatted. This can be useful for tie breaking or extra points in scoring. As before, how rigid you are in scoring units and labels will depend on the level and strength of the tournament. You do want your scoring key to be correct, especially if it is going to be provided to the teams.

The next piece of the puzzle is to decide the answer format. Many new supervisors lean toward multiple-choice answers. These are easier to write and very easy to score. Unfortunately, they make it more difficult to break ties. You will also end up with more ties. Breaking ties generally will take longer than the basic scoring. Depending on the size of the tournament and the skill levels of the teams, this can be a usable approach. But, where you are facing a large tournament or several strong teams, this approach becomes more difficult because it will introduce unwanted randomness to the results. One way to use multiple choice and reduce some of the problems is to have a lot of questions. This will separate the teams and help reduce the ties. As a rule of thumb, you probably want two or three

times as many questions as you have teams. In a very strong tournament, you may want four times as many. One other caution about multiple choice: it is easy to fall into the trap of having only one or two plausible answers. Work hard to have at least three or four plausible answers.

Once you have chosen your questions, you need to apply a scoring approach. One very typical approach is to allocate equal points to every question. The obvious drawback is that some questions are much more difficult to answer correctly. One way to handle that problem is to assign increased point values to a more difficult question. Another strategy is to break down a difficult question into several pieces so that each individual piece is easier. For example, a latitude value can be broken down into a degrees piece, a minutes piece, a seconds piece, a direction piece and a format piece (correct symbols for degrees, minutes and seconds). A third possibility is to assign different point values based on the accuracy of answers that require measurement and/or computation. An example would be a measured azimuth question. You could assign 3 points for being within $\pm 2^\circ$, 2 points for being within $\pm 3-4^\circ$ and 1 point for being within $\pm 5-6^\circ$. You do want to be careful to do your measuring with devices (e.g., a protractor) that are as accurate as you can find. And remember that not every team will have top quality equipment.

Your primary goal is a test that identifies the relative skill levels of the teams and correctly ranks them. We do recommend having enough questions so that it is very difficult for most teams to finish the test in 50 minutes. There are two reasons to take this approach. First, it will help spread the scores out and is likely to result in teams' relative skill levels being correctly assessed. The other reason is that if most teams do finish the test, the number of ties will go up. You will always have a few ties in any reasonably large tournament. You want to minimize the number of ties both to save time in scoring and to reduce the chances that a team's relative standing will be arbitrarily decided.

The next step is to pick your tie breaker questions/answers. If your test has more difficult and easier questions, then you can pick tie breakers that tend to favor stronger teams. An example would be to use measurement and math questions as your primary tie breakers. Experience tells us you will also end up with a few ties among very poorly performing teams. Breaking a tie between two teams that have not answered any of your selected tie break questions, or have gotten all of them wrong, requires an additional step. You can identify and specify an order for choosing tie breaker questions if all your planned tie breaker questions/answers do not break a tie. For example, state that if you cannot resolve ties using your planned tie breakers, ties will be broken using the questions in numerical order, either forward or backwards. Or some other reasonable approach that you can use under the time pressure at the end of a tournament. Whatever you do, plan it out and specify your approach in advance so you do not have to do it on the fly. Importantly, if the test will be given back to the teams, this is the only fair way to do it and does provide some assurance to both students and coaches that the test was fairly done.

In setting up map draw questions, the first step is to pick the actual size of your square. You will want to pick a square that is fairly easy to work with. A four-inch square makes it easy to do one-inch quarter-quarter sections (0.25 miles a side). Probably the simplest technique for setting up a square is to insert a text box with borders of the appropriate size. One thing to keep in mind is that a standard ruler with 1/16" divisions complicates changing square sizes so that the arithmetic for distances stays comparatively simple. An option would be to do the square in integer millimeters which can be easier to work with. No matter which unit of measure you use, do tell the students so they are not wasting a lot of time. It is very important to check the printed size of the square. It is very easy for printers to move the borders around enough to confuse the students.

Map draw questions can involve correctly locating the correct USGS topographic symbols, doing measurements, and the associated math. The more typical approach is to use PLSS coordinates to locate a symbol (e.g., "Put a well in NE $\frac{1}{4}$, SW $\frac{1}{4}$, Sec 14."). You can also ask, "Draw a pipeline starting at 1320' west from the southeast corner and proceed at an azimuth of 300° ." The rules permit asking the students to determine a scale based on the size of the square. This is an advanced skill and should be reserved for higher level tournaments.

Topographic profile questions do require careful looks at the ground you will be asking students to diagram. You will want be sure that the contours are readable. Depending on the level of the tournament, you will want to adjust the difficulty of the profile. One option for drawing the lines on the answer sheet is to use a table of the correct width, number of rows, a consistent row height and the horizontal borders turned on. As with map draw squares, you need to

check the printed lines carefully for printer errors. In choosing an actual line to diagram, roads or streets with spot elevations are a prime target. Section lines are also pretty easy as a reference. You can also select a line between two contours as a reference. If you do use a line that does not end in specific elevations, tell the students what values to use or how to choose them. Allow some latitude in answers in that case.

Finally, you will need to do an answer key. It is very important that key be laid out the same way as the test you are scoring. If answers are located on the test itself, then the key should be laid out the same way. Equally, if you have answer sheets, the key should match. Matching layouts speed up and improve the accuracy of the scoring during the tournament. Any question that has multiple possible answers or a range of answers should indicate that on the key. This can be helpful to you as an *aide memoire* if you are scoring the test yourself and it is crucial if you have helpers.

Most invitational tournaments and some higher-level tournaments return the tests to the students along with key. In that case, it is a great help to both students and coaches to include information about complicated questions. An easy example is computing a latitude. Include on the answer sheet the measurements you made and the math used to compute the answer. Another example is computing a distance where you must use a scale on the map to figure out the answer. Show what your measurement was and the math you used to get the answer. **It is a nice gesture to coaches to include the names of the maps used on your test and their dates.**

One final warning: Always check, recheck and re-recheck your answers. You owe it to your students to do the best job you can. Nobody is perfect and you will make mistakes! Try to have them reduced to the bare minimum before you start the test. Having somebody look at the test with a fresh eye, especially someone who knows how to do Road Scholar, is invaluable.

Technique 4: Planning and Running the Road Scholars Event

Running a Road Scholar event requires considerable preplanning. We have talked about constructing the test. But even an event as comparatively simple as Road Scholar requires some logistic planning to carry off well. Here are a few notes that may help. Most important is to be sure you have enough maps, tests and answer sheets for the tournament you are supporting. You will want to bring one or two spares for each piece. Surprisingly, you will want to bring a couple spare pencils and maybe a spare protractor and ruler. Someone inevitably ends up trying to take the test without these items. While you can take a stand that they should be penalized, that is contrary to the spirit of Science Olympiad, especially at invitationals. Take a teachable moment to remind beginners that in the future they will be on their own. You will want to bring clearly written or typed answer keys for all your helpers. Ideally, the answer keys will be laid out to exactly match the layout of the pages with answers on them. This is true regardless of whether you formatted the test with separate answer sheets or the students are answering right on the test. Giving each scorer a pen in a different color can help both the scorers and checking the tests. The tournament director will specify when they want to get an electronic copy of the test and key.

Where to find maps can be a struggle for new event supervisors. Here are a couple suggestions. Paper highway maps in quantity (10-15) can usually be obtained at highway departments and police stations at no cost. Also, highway rest areas. Most state DOTs will have an electronic highway map available to download. Commercial vendors can sell maps if you have the budget. A local AAA office may be willing to donate maps if requested, particularly by a member. Be sure to send a thank you note if you do get a donation. AAA typically releases revised maps in the late spring/early summer and may have leftover previous editions you can get. USGS topo graphic maps can be ordered online. Paper copies have a fee but pdf versions are free. USGS electronic maps use a layer approach to their data that allows reproducing smaller parts of the map that can be tailored to specific questions and printed on standard paper. Printing the whole map requires a precision color large-format printer or plotter. Your high school drafting course may have one. Other vendors like National Geographic also have topographic maps available. They will charge for them. If you make a formal request in advance using school letterhead, you may be able to get a donation. If you use non-USGS maps, you will need to provide those symbol sheets if they have them or check for a good Legend.

If at all possible, inspect the room well before the test. The most critical variable for a Road Scholar test is sufficient tables of sufficient size for the maps to be laid flat. Tables at least 2.5' x 5' are the minimum and 3' x 6' is better. Best

case is sufficient tables for students and 1-2 additional tables for scorers and supplies. If the room is unsatisfactory, talk with the tournament director. Art rooms, libraries and shop rooms often have the right kind of furniture. Avoid, if at all possible, having two teams at the same table. Even on a big table, the opportunity for cheating is a major problem. Many Road Scholar events have been held in rooms that do not meet these standards. But, try to avoid it if at all possible. Even if you cannot see the room in advance of the tournament, do get to the room early enough to be able to move furniture. Even a room with problems can be improved if you have time to do some reorganizing of the furniture. Do be sure to try to return the room to its original configuration. Taking pictures with your cell phone or a camera will be a big help in making the room as close to the original configuration as you can.

In addition to the materials mentioned earlier, a laptop can be a big help. If you have a countdown timer app installed, you can set it up so the students can keep track of the time. Also, if you have a scoring spreadsheet to help with adding and ranking the scores, this will speed up the scoring process. A simple spreadsheet that you enter the scores from each page that has answers and then sums them up both reduces the chances of adding errors and speeds up the score turn in. If you have or know someone who has the skills, it is possible to get the spreadsheet to also rank the scores. This will help a lot.

You will want to have helpers to score the tests while you are supervising the event. Trying to run the event and do the scoring at the same time is the path to doing a bad job at both. And, you will almost never have enough time at the end of the event to do all the scoring and get the results turned in on time all by yourself. Volunteers are huge help but they will need help from you to do a good job. The answer key is the first step with enough copies for all your known or hoped-for helpers. Do put notes on the answer key about any questions that require judgement or have multiple correct answers possible. In an ideal tournament, you can get together with your helpers the evening before the test and go over the test and key with them. If that is not available, giving them the key and the test during the first hour of the test, when no answer sheets are available to score, is the next best. Except in very rare circumstances, your volunteers will want to help but will not be experts in Road Scholar. This can be a dangerous combination, so try to prepare them and equip them as well as possible. Multiple choice tests are the easiest to score but do have the problems mentioned earlier. Short answer tests are harder to score and require informed judgement. Ask your scorers to come to you for resolution of any questions that require judgement.

During the actual tests, a couple of things are very important. First, be sure everyone gets the same amount of time. A late start in the first round can be matched for time in all the subsequent rounds. A late start in any round after the first, has to be referred to the tournament director immediately. Some kind of arbitration will need to take place. Be sure you have a way to contact the tournament director quickly. Never hold students past a scheduled stop time. Many will have events they must get to immediately after Road Scholar.

Next, be willing to answer questions. It is not necessary to give out the answers, only help them in a general way to find the answers. **Be nice** about it. Too many students are already afraid to ask questions even when they should. If you discover you have made an error on the test, make sure everyone gets an opportunity to have the correct information or don't grade the question. Never assume a student is wrong in thinking there is a mistake. Check to see if they are right, first. Experienced event supervisors are well aware that some students are very skilled at this event.

If you have a short briefing before each round for the students, keep it very short and sweet. Do not let the announcements go on long enough to reduce the time available for the test. The most important thing to be done before the start of actual testing is to get team names and numbers on every answer sheet. Also mention no marks on anything except answer sheets and assure students it's OK to ask questions if needed. Many pretest announcements can be incorporated as written notes for the competitors on a separate sheet on each table. At the end of each round, collect up the answer sheets or tests as needed. Make absolutely sure that team names and numbers are on every sheet with answers. Straighten up the tables and maps and distribute the next round's answer sheets or tests. If you have the time and help, check over the maps and reused tests to be sure they have not been written on.

After all the testing is over, the next most important thing is to get the tests scored and reported. If you have had helpers doing scoring, ask them to sort the completed tests into score order. This will make it easy to identify ties. It is good practice to rescore any tests with very close scores. Your scorers are hurrying and mistakes get made. Both

medals and team rankings are at stake and you want to be as accurate as possible. This is true for all teams but especially crucial in the top teams. After you have the tests scored to your satisfaction, get the data entered into whatever form the tournament director has specified. There is almost always a paper copy and, more frequently now, a spreadsheet. Once that is done, gather up the answer sheets and the scores and turn them in to tournament headquarters. The tournament director should have provided direction on whether they want the materials turned in in team number order, team name order, or score order. After that, you can relax for a couple minutes, clean up the room and call it a day.

If you are at a tournament that needs to reuse your room for another event, you will need to pack everything up and move to a scoring room as soon as your last round is over. Some preplanning for that will help a lot. This is typically a problem when at smaller schools. Science Olympiad tournaments require a lot of rooms for events and team rooms.

Finally, be aware of the possibility of cheating. If you have to put two teams at one table, this is a very serious issue. In that circumstance, very aggressive proctoring is called for. If each team has its own table, this is less of a problem, but do keep moving and watching during the test. Our experience is that cheating is very rare in Road Scholar, but not unknown. If you have identified suspected or actual cheating, segregate the offenders first and then contact the tournament director immediately. Of course, you want to be very sure in this circumstance. If you think it is a close call, moving the students to another table can be a minimally disruptive solution.

When you are running the event, the main focus needs to be on allowing students to do it in a way that allows them to fairly show you their actual skills and be properly ranked.

Technique 5: Tiebreakers and Decimal Scoring

Ties are normal with any Science Olympiad written test. We have already talked about how to select tie-breaker questions. There are several techniques available for handling tie scores before they have to be turned in. The method recommended here is well used in the Science Olympiad community, simple to use and supports any situation where the scores have to be entered into a spreadsheet. The entering argument is that the test is initially scored using whole numbers. If your questions allow fractional scores, then there is an additional step needed. Start by breaking the ties using your tie breaking procedures. For the team that wins the tie break, change their score by adding the same value of tenths of a point as there are teams tied. As an example, in the usual case of two teams tied, the winner of the tie break gets 0.2 added to their total score. The losing team gets either 0.1 added to their score or their score is just left as the integer value. If you have more than two teams tied, then continue to break the ties until all the teams are separated. For example, in a four team tie (very rare, but not unheard of), the winning team of the tie breaks gets 0.4 added to their score, the next best team gets 0.3 added to their score, the third best team gets 0.2 added to their score and the losing team gets 0.1 or nothing added to their score. Particularly where the scores need to be loaded into a spreadsheet, this a simple, proven way to handle ties. In the event you test is set up in way that provides fractional scores, you will need to check your tie breaks to be sure they have not given a team enough points to tie or leapfrog a better scoring team.

Best wishes for good luck and doing well!