

Jackson State University Mathematics and Engineering Fair 2017 Competitions and Rules

All student participants in the Mathematics and Engineering Fair must take the Mathematics Written Examination and participate in at least one other competition. The rules for each competition are provided. Individual events and their rules are presented and followed by team events. In addition to individual and team events, there is a student recognition award, the Dr. William White Award, which allows mathematics teachers to recognize and encourage a student to pursue studies in mathematics-related fields. A letter of recommendation from a current or past mathematics teacher is required for the Dr. William White Award.

INDIVIDUAL EVENTS

Mathematics Written Examination Competition

1. The Individual Mathematics Written Exam will cover the topics in algebra, geometry, trigonometry, and introductory calculus.
2. It is recommended that students study ACT and SAT type exercises to prepare for this exam.
3. No Calculators may be used during this exam.
4. No books, websites, notes, or other references may be used during this exam.
5. Use of visual aids is allowed for participants who have a visual impairment. Please contact the Fair Director for any prior arrangements.
6. The Mathematics Written Exam will consist of 30 to 40 multiple choice questions and will last 60 minutes.
7. During the Mathematics Written Exam, there will be absolutely no communication between students from the time the exams are handed out to the time the answer sheets are collected.
8. Proctors will give 5-minute and 1-minute warnings.

At the end of 60 minutes, students must submit their completed official answer sheet and test paper to the Proctor.

Mathematics Exhibits Competition

Students will prepare a project and present it using a tri-fold presentation board (as used in most science fairs). The board will promote an appreciation and understanding of the role of mathematics in science, nature, technology, or culture. Students may enter projects that were completed in one of their high school classes. Examples of accepted projects are demonstrations of unique procedures for solving a mathematical problem, proofs of mathematical conjectures, or illustrations of the historical development of mathematical concepts.

The boards will be judged on creativity, educational value, completeness of thought, neatness, and originality. There is no limit on the number of participants per school. Each participant may submit only one project. The back of the board should include the school name and the name of the participant.

Mathematics Essay Contest

The theme for the Mathematics Essay Contest is also the theme for this year's Fair – Your Place on the Grid: Big Data Influences on Your Life.

With any profession large volumes of data will affect and shape your daily choices and decisions in the workplace. While knowledge of your field of study is necessary to be successful in healthcare, politics, and business and other industries; the technological age that we live in also requires the ability to collect, analyze, understand and communicate an enormous amount of information, or 'Big Data'. To effectively utilize Big Data professional training in mathematics, statistical science, and computer science is needed.

The contestant will explain how 'Big Data' is employed to discover patterns, forecast trends, and make better decisions in all activities linked with our daily lives. The essay may focus on how mathematics is used to mine large data sets, optimize expected outcomes and visualize the aspects of data that inform our understanding of climate change, weather systems, genome sequencing, social networking, or other 21st century concerns. The rubric used to score essays is included at the end of this document.

All essays must comply with the following contest rules before submission:

- No literary form other than an essay will be accepted.
- Each essay must reflect the contestant's own research, writing and original thinking. Plagiarized submissions will be disqualified.
- Only one (1) essay may be submitted by each student.
- Teachers must verify that the essay is the student's original work.
- Essays must be typed and submitted in Microsoft Word or *PDF* format.
- The essay text is limited to three (3) double-spaced, single-sided, numbered pages with one-inch margins, and 12 pt Times New Roman font. The title page and reference page is not included in the three pages of essay text.
- Each essay must include a title page, not considered text, with the following information:
 - Essay title
 - Author's name
 - School name
 - School address
 - School telephone number
 - Total number of pages of essay including the title and reference pages
 - Name of supervising teacher
- Each essay should also include a reference page of sources used to compose the essay. APA or MLA format is acceptable.
- The title of the essay, but NOT the author's name, MUST appear on the top of the first page of essay text.
- The rubric used to score the essay is included at the end of this document.
- **Entries must be emailed to jun.liu@jsums.edu by March 22, 2017.**

TEAM EVENTS

Mathematics Bowl Competition Rules

A. General

1. Each school is allowed **one** team of four (4) players. A fifth (5th) player is allowed as an alternate. The alternate may replace a team member in case of (a) an illness or other emergencies or (b) interchanges between rounds.
2. Prior to a competition each team will designate a captain. Once a match has begun, only the captain may question the judge regarding scores, sequence and general information.
3. There will be a judge, a moderator, a scorekeeper and a timekeeper.
4. DURING COMPETITION, ALL PARTICIPANTS ARE RESPONSIBLE FOR RULES AS WRITTEN.
5. During the competition, no recording by the audience, whether written, visual or audio will be allowed.
6. The audience is required to keep quiet during the competition.

B. Questions

1. The Bowl Competition will be played during the Mathematics and Engineering Fair day and the questions will be in ACT and SAT format.
2. Each team will compete in two preliminary rounds against different teams. Each match will have two to three teams competing with each other. The three teams with the highest total score after two rounds will move into the final round.
3. In the final round, the team's score will start again at zero. The final round will determine the champion as well as the second and third place.
4. When a question is being read, team members are to sit at the tables with their hands on their sides. Team members will begin problem solving after the moderator says "GO."
5. Paper and pencils will be provided for problem solving. The final answer must be written down and handed to the judge.
6. Teams will be given 1 minute to compute and solve each problem. Once the time is up, all teams should stop working on the problem.
7. Each match will consist of the same number of problem questions, up to 12, for each team to solve. Each question is worth 10 points.
8. The questions will be addressed to one team at a time, alternating between teams. In case the first team gives an incorrect answer, the other team(s) will get the chance to score 5 points if their answer is correct. A random drawing will be made at the beginning of the match to decide which team gets the first question.
9. Questions will be numbered and at each stage the team will pick a number randomly and the corresponding question will be asked. Once a question is asked the corresponding number is removed.
10. In case of a tie, the tied teams will be asked the same question, and the team who answers correctly, first, will win.
11. A standard scientific calculator is allowed. No graphing calculator is permitted.
12. Neither the coach nor any member of the audience may help a team in any way with a question.

Bridge Design and Construction Competition

The application asks that you indicate if you plan to have a team or teams participating in the Bridge Design and Construction Competition. You will be asked to affirm the number of teams participating and the members on each team by **March 22, 2017**. Multiple teams are permitted for each school. Each team should consist of at least two and no more than five members.

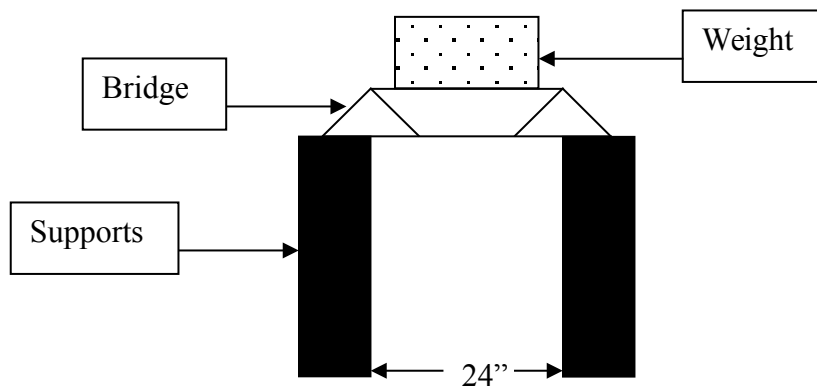
The completed bridge will be inspected and checked in at Jackson State University on the day of the Mathematics and Engineering Fair.

The requirements with respect to **dimensions** are:

- ✓ Overall length of bridge must be between 26" and 30"
- ✓ Bridge must span 24"
- ✓ Maximum height of bridge is 5"
- ✓ Maximum width of bridge is 8"
- ✓ Minimum width of bridge is 6"
- ✓ Each individual Balsa wood beam shall be 1/8" wide by 1/8" thick.

The **rules** for the Bridge Design and Construction Competition are:

1. Student groups will consist of 2-5 students.
2. All materials used in the design and construction of the bridge must be Balsa wood. Balsa wood is available at local hobby stores.
3. Loading will be applied at the center span using a top-loading weight system as seen in the diagram below. (Weight system and supports will be provided.)



4. Mechanical fasteners are not allowed.
5. Glue may be placed on the face of the joint being glued and not on the side face. Joints should not be surrounded by glue. Glue may not be spread more than 1/4" beyond the glued joint. Any non-permitted use of glue will be penalized.
6. The bridge may not be painted, coated, laminated or treated in any way.
7. Emergency balsa wood and glue on the day of the fair must be provided by the individual teams.
8. Safety glasses will be provided.

Judging

1. Judging of the bridges will be based on an efficiency factor.
2. The bridge will be weighed and impounded until it is loaded.
3. Teams will have 5-7 minutes for bridge setup and loading. Students will self-load bridges.
4. The bridge is considered to have failed if it collapses and cannot support any weight, or the bridge deflects 4" or more from horizontal.
5. The efficiency factor is the applied load divided by the weight of the bridge. The applied load is the load that causes the bridge to fail, or 20kg (44 lbs.), whichever occurs first.
6. The highest efficiency factor will be the winner.

For further questions concerning the Bridge Design and Construction Competition, contact Dr. Himangshu Das at himangshu.s.das@jsums.edu or (601)-979-0549.

Math Trail Competition

Teams of students will go to 10 different, designated locations in the Just Science Hall Building and work together to answer mathematics/problem solving exercises posted at those locations. Each school is allowed one team with up to four student participants. The teams will not be racing against each other. However, each team will want to be sure to make it to all 10 stops in the allotted time (60 minutes). Individual teams should only discuss answers/solutions with each other. There should be absolutely no outside assistance. Each team will be provided with an answer sheet which includes these instructions and clues for locating the 10 stops. Scratch paper will also be provided. All answers should be recorded on the answer sheet. After teams have answered their last question, they will turn in their answer sheets at the designated central location from which all of the teams will begin. The team with the most correct answers will win the competition. In the case of a tie, a tie-breaker question will be given to those teams, and the team who solves the question first will win the competition.

Water Bottle Rocket Design

The Water Bottle Rocket Competition serves to familiarize students with the basic principles of rocketry, design engineering, and manufacturing engineering. The purpose is to design a Water Bottle Rocket capable of reaching the highest altitude possible given specific launch criteria. Each team will design a Water Bottle Rocket at Jackson State University the day of the competition using a using materials supplied by JSU. Prior to the event day, teams should research water bottle rocket design. Each school is allowed one team of four students.

Fun with Calculators Competition

In the *Fun with Calculators* Competition, students will use scientific calculators to do mathematical computations. With the answers from their computations, the students are asked to identify a word, name, abbreviation, word root, prefix, suffix, phrase, or sentence. Some calculations have a bonus item, and the team that gets the computation first will have the first chance to answer the bonus item. If the first team cannot answer the bonus item, the next higher numbered team will have a chance to answer the bonus item until each team has tried once. A team can get a maximum of two points from each computation (one point for the computation and one point for the associated bonus item). The competition covers a variety of subject areas including natural science, social science, language arts and fine arts, industrial arts (tools and/or goods), general education, and abbreviations. The team with the most number of points wins the game. Each school is allowed one team with up to three student participants. Each team participant is asked to bring a Scientific Calculator. Graphing calculators are not permitted. For questions concerning the Fun with Calculators Competition, contact Dr. Roosevelt Gentry at roosevelt.gentry@jsums.edu or (601)-979-3764.

STUDENT RECOGNITION AWARD

Dr. William White Award

This award is given in honor of the late Dr. William White, a former Associate Dean of the College of Science, Engineering and Technology and Professor of Mathematics. Each school may nominate one student for whom they would like to inspire to pursue advanced studies in a mathematics-related discipline. The nominee may have demonstrated habits or interests in STEM disciplines, and the teacher wishes to motivate the student to achieve. **A letter of recommendation is required no later than March 22, 2017**, in order for the student to be considered for this award. **From this year, each nominated student is also required to submit a personal statement (1-2 pages) on his/her life and study experience related to STEM along with the letter.** The letter of recommendation must come from a current or past mathematics teacher. During the awards ceremony, each nominee will be recognized, and one nominee will be presented with an award.

Mathematics Essay Contest Rubric

Essay Prompt: The essay should address the theme for this year’s Mathematics and Engineering Fair, ***Making Sense of Big Data***. The contestant should explain how large data sets are used to inform practitioners and the general public about current, social and scientific concerns. The essay may focus on how mathematics is used to mine large data sets, discover patterns and visualize the aspects of data that inform our understanding of climate change, weather systems, genome sequencing, social networking, or other 21st century concerns.

	A (6 points)	B (4 – 5 points)	C (2 – 3 points)	D (1 point)
Responds to Prompts	Clearly and effectively responds to essay prompt.	Response to prompt is generally adequate and thorough.	Minimally responds to the essay prompt.	Does not respond well to essay prompt.
Demonstrates understanding of large data sets and addresses visualization or some other technique to make sense of big data	Demonstrates exceptional understanding of large data sets, the concept of data mining, and how visualization is used in science, engineering, technology, and/or mathematics. Uses examples, illustrations from own experiences and/or references to elaborate.	Demonstrates understanding of large data sets, the concept of data mining, and how visualization is used in science, engineering, technology, and/or mathematics.	Demonstrates some understanding of large data sets, the concept of data mining, and how visualization is used in science, engineering, technology, and/or mathematics.	Demonstrates poor understanding of large data sets, the concept of data mining, and how visualization is used in science, engineering, technology, and/or mathematics.
Organizes thoughts, appropriately using paragraphs and transitions	Organization and structure of essay very evident: major points divided into paragraphs and signaled by use of transitions. Consistent and appropriate voice and tone.	Clear organization and structure. Most major points are separated into paragraphs and signaled by transitions.	Organization and structure mostly clear. Many major points separated into paragraphs and signaled by transitions. Most points logically developed. There may be a few minor digressions but no major ones.	The organization and structure of the essay must be inferred by the reader. Only some major points are set off by paragraphs and are signaled by transitions.
Uses voice and tone appropriately	Consistent and appropriate voice and tone.	Consistent and appropriate voice and tone although somewhat generic.	Adequate voice and tone although often generic.	Some major digressions from the main topic. Voice and/or tone noticeably generic.
Follows grammar rules and conventions	Full variety of sentence structures used correctly. Word choice is interesting, accurate and contributes to communication of response. Few, if any, minor errors in sentence construction, spelling, grammar, or mechanics.	Varied sentence structures used correctly with occasional flaws. Word choice is accurate and contributes to communication of response. Few minor or major errors in sentence construction, spelling, grammar, or mechanics.	Occasional errors (major and minor) in sentence structure, spelling and mechanics to communicate response but the writer generally demonstrates a correct sense of syntax.	Little variety in sentence structure and/or wording. Numerous minor and major errors in sentence structure, spelling, grammar, or mechanics that interfere with writer’s ability to communicate response.

Evaluator: Assign a single point value for each of the five (5) indices on which the essay is being evaluated. Select the point value that most accurately represents the competitor’s essay. Use additional page(s) to provide any special explanations for your score assignment.