Science and Engineering Fair Handbook

February 7th, 2019

Finalists will go to the

San Joaquin County Science and Engineering Fair

Ethics Statement

Scientific fraud and misconduct are not condoned at any level of research or competition. This includes plagiarism, forgery, use of presentation of other researcher's work as one's own and the fabrication of data. Fraudulent projects will not be tolerated and will be disqualified.

Eligibility

- Each student may enter only one project that covers research done over a maximum of 12 continuous months between February 2018 and February 2019.
- Projects that are demonstrations, 'library' research or informational projects, 'explanation' models, or kit building are not appropriate.

General Requirements

1. Projects must adhere to the Ethics Statement above.
2. Projects must adhere to local, state, country and U.S. Federal laws, regulations and permitting conditions.
3. The use of non-animal research methods and the use of alternatives to animal research are strongly encouraged and must be explored before conducting a vertebrate animal project.
4. Projects must adhere to the display and safety requirements found in this handbook.
5. It is the responsibility of the student and coach to check with the SJCSEF Fair Coordinator for any additional restrictions or requirements.
6. Projects should NOT have any identifying information i.e. the student's name/picture, teacher's name/picture or school name/picture on the ***front*** of any project.
7. **All restricted projects must have proper documentation before experimentation.** Details listed in section "Restricted Projects".

Divisions and Teams

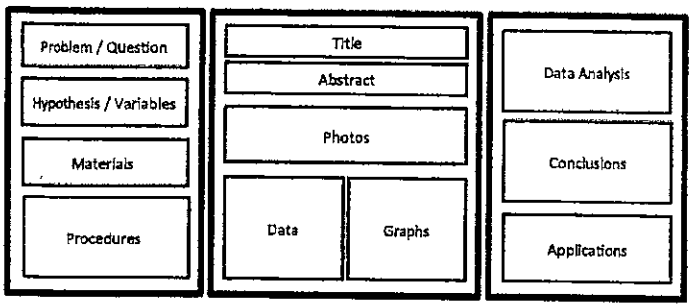
- Divisions: K-2, 3-5, 6-8, 9-12
- Teams: Team projects may have a maximum of three members. All team members will need to have their own notebooks, but only one board and abstract are required.
- Whole Class: The K-2 division only is allowed to participate as a whole class. All students will need to have their own notebooks, but only one board is required.

Project requirements

1. Tri-fold board or Poster: Limited to 121 cm (4 feet) side to side, 92 cm (3 feet) top to bottom, and 93cm (3ft) front to back.

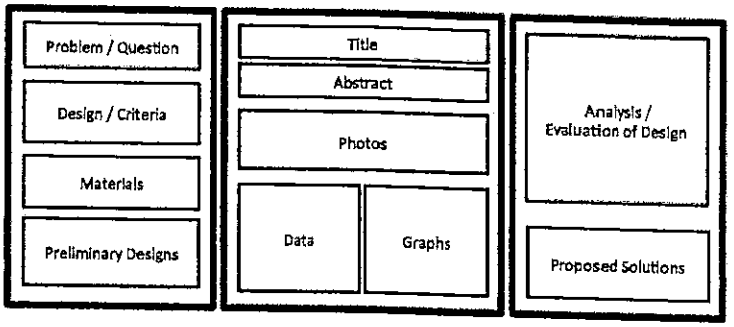
a. Posters are also permitted as long as they fit the same dimensions.

Science Projects



The board is a visual representation of your project. This is a sample of what components should be on your board. However, organize your board to fit the needs of your project.

Engineering Projects



The board is a visual representation of your project. This is a sample of what components should be on your board. However, organize your board to fit the needs of your project.

b. Realia or models NOT allowed unless called for an interview.

c. Pictures on the display that do not model appropriate safety procedures will not be allowed.

2. Abstract: One per project (not required for K-2).

• The abstract is a summary of the entire project that includes the following details. (Maximum of 250 words.)

- **Objective or Goal:** Summarize what you will accomplish.
- **Materials and Methods:** Summarize the materials and methods.
- **Results:** Summarize the results of your experiment and indicate how they pertain to your objective.
- **Conclusion/Discussion:** Indicate if your results supported your hypothesis or enabled you to attain your objective. Discuss briefly how information from this project expands our knowledge about the category subject.

• Put the abstract on the board OR provide a copy.

- People will read your abstract more than any other part of your project.
- The abstract should be the last thing you write.

• Visit the California State Science Fair website for examples.
http://cssf.usc.edu/Info_Genl/Writing_Abstract.html

3. Handwritten notebook:

• One **per student** participant (including K-2).

• MUST be an ongoing dated log of everything.

- Should be an authentic representation of entire project.

- Should show evidence of student thinking, brainstorming ideas, processing and reflection of what occurred. For example:
    - How the student will go through testing or the creation of a procedure. Must be detailed and identify variables and controls as applicable. In the writing be sure to include MULTIPLE TRIALS!
    - A detailed list of ALL materials should also be contained in the journal. It is recommended that in grades 6-12, all measurements should be in metric form.
    - All data collected as applies, engineering design, mathematical computations or coding, technology development.
    - Analysis of data or procedure. This should be in-depth, not just one or two sentences.

    - Not only should the conclusion include whether the hypothesis was proven, or if the engineering was feasible, or if the programming or mathematical evaluation worked, but also why and what are your "next steps" or further questions.
    - Notebooks should include **annotated research information** NOT just a bibliography. (Excluding K-2)
    - Acknowledgements: Note credit given to parents, teachers and other sources. Don't leave anything out!

Restricted Projects

A restricted project requires pre-approval from a Science Review Committee (SRC) or Institutional Review Board (IRB) before experimentation can begin. A restricted project needs to be approved to make sure no harm will be done to humans or animals.

- The SJCSEF SRC is responsible for approval of any student project involving tissue/cell lines, human subjects, vertebrate animals and/or potential hazardous and dangerous materials or equipment.
- The SJCSEF IRB is responsible for approval of student projects involving potential physical and/or psychological risk involving humans. The IRB is responsible for assessing and documenting the level of risk.

- **Pre-Approval and Documentation**

a. Complete a "Cover page"

b. Complete a "Research plan." A research plan is a succinct detailing of the rationale, research question(s), methodology, and risk assessment of your research project and should be completed **before** the start of your experimentation.

c. Complete additional documentation relating to the type of project. See the following pages for more details.

d. Submission of necessary paperwork for restricted projects that require pre-approval are due to Mrs. Romine **no later** than **December 14, 2018**. Plans can be submitted starting in November 2018.

All students/teachers need to review the requirements for projects that require pre-approval by the SJCSEF Scientific Review Committee (SRC) and/or Institutional Review Board (IRB). If your project needs pre-approval the below information applies. All links to the necessary forms and templates needed for pre-approval can be found at http://sjcoesciencefair.weebly.com/safety.html

Projects that are not allowed for ANY grade level

- **NO** blood products, human fresh tissue, and bodily fluids. The student researcher may not handle blood of another person or vertebrate animal. Student researchers may handle their own blood, tissue or other bodily fluids but not of any others. EXCEPTION: Student researchers may ask a medical professional to do the taking of the blood or bodily fluids of other individuals or vertebrate animals and do the analysis to GIVE the data to the student researcher (with pre-approval from the SJCSEF SRC/IRB)
- **NO** Vertebrate animal parts. (Exception is Zebra fish eggs up to the 7th day (168 hours) after fertilization. After this time Zebra fish eggs are considered to be vertebrate animals too.)
- **NO** Pathogenic agents (Biological Safety Level {BSL} 2+).
- NO Recombinant DNA (rDNA).
- **NO** Ingestion (tasting, eating, inhalation or drinking) of any substance by **human** or **vertebrate** animal subjects.
- NO Carcinogenic, mutagenic and potentially toxic chemicals/fumes.
- **NO** Explosive or flammable chemicals/gases,
- NO Radioactive materials.
- NO Compressed gas (including, but not limited to CO2)
- **NO** guns, potato cannons, paint ball guns, bows/arrows – or other dangerous projectiles.
- NO High voltage equipment.
- **NO** Lasers (except class I with eye/skin protection) or use of ionizing radiation X-rays or nuclear energy.
- **NO** introduction of non-native and/or invasive species, pathogens, toxic chemicals or foreign substances into the environment.
- **NO** prescription drugs, alcohol or controlled substances.
- **NO** dry ice or liquid nitrogen or other dangerous liquid gases.

Category Descriptions

Animal Sciences: Study of animals – genetics, ornithology, ichthyology, herpetology, entomology, animal ecology, paleontology, cellular physiology, circadian rhythms, and animal husbandry, cytology, histology, animal physiology.

Behavioral and Social Sciences: Human and animal behavior, social and community relationships – psychology, sociology, anthropology, archaeology, ethnology, linguistics, learning, perception, urban problems, reading problems, public opinion surveys, educational testing.

Biochemistry: Chemistry of life processes – molecular biology, molecular biology, molecular genetics, enzymes, photosynthesis, blood chemistry, protein chemistry, food chemistry, hormones, etc.

Chemistry: Study of nature and composition of matter and laws governing it – physical chemistry, organic chemistry (other than biochemistry), inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry, etc.

Computer Science/Mathematics: Study and development of computer hardware, software engineering, Internet networking and communications, graphics (including human interface), simulations/virtual reality or computational science (including data structures, encryption, coding and information theory.) Development of formal logical systems or various numerical and algebraic computations, and the application of these principles – calculus, geometry, abstract algebra, number theory, statistics, complex analysis, probability.

Earth and Space Sciences: Geology, mineralogy, physiography, oceanography, meteorology, climatology, astronomy, speleology, seismology, geography, etc.

Engineering: Judging for engineering projects is slightly different from other categories. These projects directly apply scientific principles to manufacturing and practical uses – civil mechanical, aeronautical, chemical, electrical, photographic, sound, automotive, marine, heating/refrigeration, transportation, environmental, etc.

Environmental Science: Study of pollution (air, water, and land) sources and their control; ecology.

Medicine and Health: Study of diseases and health of humans and animals – dentistry, pharmacology, pathology, ophthalmology, nutrition, sanitation, pediatrics, dermatology, allergies, speech and hearing, etc.

Microbiology: Biology of microorganisms – bacteriology, virology, protozoology, fungi, bacterial genetics, yeast, etc.

Physics: Theories, principles, and laws governing energy and the effect of energy on matter – solid state, optics, acoustics, particle, nuclear, atomic, plasma, superconductivity, fluid/gas dynamics, thermodynamics, semiconductors, magnetism, quantum mechanics, biophysics, etc.

Plant Sciences: Study of plant life – agriculture, agronomy, horticulture, forestry, plant taxonomy, plant physiology, plant pathology, plant genetics, hydroponics, algae, etc.

Awards

Awards are determined based upon the judges' evaluations of the project according to the SJCOE rubrics. Team members will each receive his or her own ribbon.

Category Place Awards Finalist, first, second, and participant ribbons will be awarded in each grade band, K-2, 3-5, 6-8. In addition, there is a Whole Class Award for K-2. There can be multiple place awards dependent upon the outcome of the judging points within each grade band, meaning there may be more than one finalist, or none. Finalists will continue on to the San Joaquin County Science and Engineering Fair on Friday, February 22nd, 2019.

SJCSEF Rubric **SCIENCE** K-2

Project #	**Judges Initials:**
Project Title:	

		Points
Problem/Question To what degree is the problem student or class generated? Is it clear and concise? Written in the form of a question.	0=No Problem Statement. 1=Poorly written Problem Statement/Question (not in question form). 2=Problem is simplistic and perhaps taken from source. Unoriginal. 3=Complete well written Problem/Question in the form of a question and has a unique approach (a variable may have been changed) 4=Above expectations-detailed, well written and innovative.	
Hypothesis To what degree is the prediction testable? Relates to students' prior experience. (Shows cause and effect an "if" /"then" statement)	0=No hypothesis. 1=Incomplete hypothesis. 2=Complete hypothesis but not completely testable. 3=Hypothesis is well written and testable.	
Materials All materials are listed in; column form, with unit of measure (consistently).	0=No materials identified or used. 1=Materials not specifically identified (e.g. water) 2=Materials specifically identified (e.g. a type of water) 3=Materials listed specifically including quantities (e.g. 50 ml of water at room temp.) 4=Materials listed and complete and unit of measure is consistent and includes enough detail for all trials conducted (e.g. 50 ml of water at 21°C)	
Procedure Procedure is sequential (numbered), replicable. If this is a class project, student participation must be evident.	0=No overall procedural plan to confirm hypothesis. 1=Partial procedural plan to confirm hypothesis (may not include class). 2=Sufficient procedural plan to confirm hypothesis. 3=Well-written plan with sequential steps and class participation is evident.	
Variables Test (independent) Outcome (dependent) Control (comparison) Constant (conditions are the same)	0=No variables or constants are recognized. 1=Some variables or some constants are recognized. 2=All variables are recognized but not all controls (or visa versa). 3=All variables and controls are recognized but not labeled on board or in notebook. 4=All variables & controls are clearly and appropriately recognized and written on the board and in the notebook.	
Data Is there both qualitative and quantitative data, are they labeled correctly and summarized.	0=No data has been included. 1=Partial data included (may be missing qualitative or quantitative). 2=Inclusion of both types of data, may not be labeled correctly. 3=Inclusion of all data types and labeling is accurate & appropriate.	
	Subtotal front	

Results/Conclusion To what degree are the conclusions recognized and interpreted? Students show or tell what they learned. What other questions could they come up with from this project?	0=No problem statement or interpretation of data support for hypothesis identified. 1=Incomplete problem statement or interpretation of data support of the hypothesis. 2=Correct/complete conclusion from data support for hypothesis. 3=Well-written conclusion of data support for hypothesis.	
Display Attributes Attractive, clear, legible and in appropriate order	0=Unsatisfactory display – attributes missing. 1=Poor quality of display with little attention to detail. 2=Average quality but board organization hinders communication. 3=Good quality – but the addition of more components would improve communication or layout hinders communication. 4=Superior display – layout and organization facilitates communication.	
Notebook (s) Students write in their own words, (recognizable inventive spelling is acceptable). Includes original illustrations and thoughts.	0=No individual information written in students own words. 2=All journals have the exact same wording but pictures are varied. 4=Some written information is the same, pictures are varied. 6=Most information is written in the students' own words and pictures are varied. 8=Students reflect in their own words what they learned, includes all of the above of the project per student. Includes graphs/tables.	
Overall Quality To what degree does this project relate to broader scientific principles and real world applications, is original or has an innovative approach to the topic or shows a high degree of complexity	0=Very little degree of originality and or complexity. 2=Some relevance to real world application but low degree of originality or complexity. 4=Some originality (changing a variable or two), or complexity, may or may not relate to real world yet not identified by the student. 6=A degree of originality, complexity, and has real world application to broader scientific principles and innovative. 8=Very innovative and original. Complexity and application to broader scientific principles is high.	
	Subtotal back	
	TOTAL POINTS_____/44	

Updated 8/2016 – Corrected total points, no change to content of rubric - LFG

SJCSEF Rubric **ENGINEERING** K-2

Project #	**Judges Initials:**
Project Title:	

Define A Problem Or Need The purpose is clearly and succinctly stated. It may be an improvement or a new design.	0=No need or problem is stated. 2=Poorly written Problem Statement or unclear focus. 4= Well-stated problem or need however approach to the design taken from a source. 6=Original and unique project that addresses or solves a real need and has a good approach. Clear logical objective that is succinctly stated.	
Design / Criteria Design criteria are requirements that the student specifies that will guide the development of the design.	0=No design criteria or specifications of design listed. 2=Poor design criteria or constraints outlined. 4=Minimal design criteria may be incomplete in scope or constraints. 6=Complete design criteria outlined, design is clear and constrains are clearly outlined.	
Prepare Preliminary Designs Does the student clearly understand the design that was developed and used? Does the student consider multiple solutions?	0=No initial design provided. 2=No iteration of the design process is considered and some sketches are evident. 4=Multiple iterations of the design solutions are considered. Sketches, models and dimensional drawings are shown. 6=Multiple solutions are generated and alternatives seriously considered. Criteria for rejecting alternatives are well stated and used. Quality sketches, models, and two-dimensional drawings are evident and their use is apparent.	
Build, Test And Retest A Prototype Students will need to test and retest their design noting any adjustments and making design changes as needed.	0=No test or prototype evident. 2=A prototype has been created yet tested only a minimal number of times. 4=The prototype has been tested multiple times however adjustments and changes are not made. 6=The prototype has been tested multiple times and adjustments and changes have been noted and logical corrections made.	
Analysis And Evaluation Of The Design To what degree does has the design been developed	0=No written narrative or analysis or evaluation. 2=Analysis of design may not be logical or may not mention the criteria used for success. 4=Analysis of the design solution is logical and there is some mention of economic and ecological feasibility. 6=Analysis is logical and there is good analysis of economical and ecological feasibility and or scale in the application of the design solution.	
	Subtotal front	

Notebook (s) Students write in their own words, (recognizable inventive spelling is acceptable). Includes original illustrations and thoughts.	0=Very little degree of originality and or complexity. 2=Some relevance to real world application but low degree of originality or complexity. 4=Some originality (changing a variable or two), or complexity, may or may not relate to real world yet not identified by the student. 6=A degree of originality, complexity, and has real world application to broader scientific principles and innovative. 8=Very innovative and original. Complexity and application to broader scientific principles is high.	
Display Attributes Attractive, clear, legible and in appropriate order. Workmanship on the design is thorough and attention to detail is noted.	0=Unsatisfactory display – attributes missing. 1=Poor quality of display with little attention to detail. 2=Average quality but board organization hinders communication. 3=Good quality – but the addition of more components would improve communication or layout hinders communication. 4=Superior display – layout and organization facilitates communication.	
Overall Quality To what degree does this project relate to broader scientific principles and real world applications, is original or has an innovative approach to the topic or shows a high degree of complexity.	0=Very little degree of originality and just building from found directions. 2=Some relevance to real world application but low degree of originality or complexity. 4=Some originality (changing a variable or two), or complexity, may relate to real world yet not identified by the student. 6=A degree of originality, complexity, and has real world application to broader scientific principles and innovative. 8=Very innovative and original. Complexity and application to broader scientific principles is high.	
	Subtotal back	
	TOTAL POINTS _____ / 50	

SJCSEF Rubric **SCIENCE**

Please circle: 3-5 6-8 9-12

Project #	**Judges Initials:**
Project Title:	

Abstract To what degree does the abstract describe the project? (Maximum of 250 words)	0=No abstract. 1=Poorly written and does not describe the project. 2=Poorly written and does not describe all components of the project. 3=Well-written but does not describe all components of the project. 4=Well-written and completely describes the project.	*Points*
Problem/Question To what degree is the problem statement new and/or different for a student at this grade level and was it written well?	0=No Problem Statement. 1=Poorly written Problem Statement/Question (not in question form). 2=Problem is simplistic and perhaps taken directly from a source. 3=Complete well written Problem/Question in the form of a question and has a unique approach (a variable may have been changed) 4=Above expectations-detailed, well written and innovative.	
Background Research- Research should show that the student has acquired new knowledge about the nature of the problem and what others have done on similar problems.	0=No evidence of investigation or research. 1=Minimal evidence of research. 2=Some research with evidence of reading about the problem but lacking depth, (minimal sources cited or information used to guide work). 3=Good background research, however student does not fully apply found knowledge to his or her project (multiple sources are used). 4=Good research and evidence that student has used new knowledge as the foundation to move in a new direction (multiple sources used).	
Hypothesis To what degree is this a testable prediction? (Shows cause and effect). "If, then" statement.	0=No hypothesis. 1=Incomplete hypothesis. 2=Complete hypothesis but not aligned to appropriate dependent and independent variable. 3=Hypothesis is well written identifies the appropriate dependent and independent variable. 4=Hypothesis is detailed, based on key relevant information well written, testable.	
Materials All materials are listed in; column form, with unit of measure (consistently).	0=No materials identified or used. 1=Materials not specifically identified (e.g. water) 2=Materials specifically identified (e.g. a type of water) 3=Materials listed specifically including quantities (e.g. 50 ml of water at room temp.) 4=Materials listed and complete and unit of measure is consistent and includes enough detail for all trials conducted (e.g. 50 ml of water at 21°C)	
Procedure Procedure is sequential (numbered), replicable, and sentences begin with verbs.	0=Overall procedures are missing or not appropriate to support work on the board. 1=Partial procedures listed but those that are listed are detailed and appropriate 2=Complete procedures listed with some issues with writing or formatting 3=Well-written procedures with sequential steps but may not mention number of trials or repeatability. 4=Well-written as above and detailed **including trials and repeatability.**	
Variables Test (independent) Outcome (dependent) Control (comparison) Constant (conditions are the same)	0=No variables or constants are recognized. 1=Some variables or some constants are recognized. 2=All variables are recognized but not all controls (or visa versa). 3=All variables and controls are recognized but not labeled on board or in notebook. 4=All variables & controls are clearly and appropriately recognized and written on the board and in the notebook.	
	Subtotal front	

SJCSEF Rubric **SCIENCE** Please circle: 3-5 6-8 9-12

Data Is there both qualitative and quantitative data, are they labeled correctly and summarized	0=No data has been included. 1=Partial data included (may be missing qualitative or quantitative) or minimal info to support in notebook. 2=Inclusion of both types of data, may not be labeled or organized clearly. 3=Inclusion of both data types and labeling aides in communication, but not summarized for content. 4=All types of data included, labeled correctly and **summarized for content**	
Results/Data Analysis To what degree have the results been interpreted, averaged, the variables been addressed, and include sources of error?	0=No written narrative interpretation of data or no processing of data. 2=Partial written narrative interpretation of data or limited processing of data. 4=Correct written narrative interpretation of data and limited processing. 6=Correct written narrative and appropriate processing of some data. 8=Comprehensive and significant interpretation of data and addresses **all** variables.	
Conclusion To what degree are the conclusions recognized and interpreted? Including the purpose, hypothesis, unresolved questions or further tests.	0=No claim or interpretation of data used to address stated hypothesis 2=claim is unclear or no use of data to support or refute the hypothesis. 4=claim is clear in conclusion and partial use of data used to support or refute hypothesis. 6=Well-written conclusion and data is used to support the claim that is tied to supporting or refuting the hypothesis. Reasoning may not be clear or complete. 8= Well-written conclusion and data is used to support the claim that is tied to supporting or refuting the hypothesis. Reasoning is clear and complete.	
Display Attributes Attractive, clear, legible and in appropriate order.	0=Unsatisfactory display – attributes missing. 1=Poor quality of display with little attention to detail. 2=Average quality but board organization hinders communication. 3=Good quality – but the addition of more components would improve communication or layout hinders communication. 4=Superior display – layout and organization facilitates communication.	
Notebook The development of problem/question and the hypothesis, explains what variables and controls are included and the number of trials to be done, there is an on-going record of the experiment and shows analysis and reflection	0=Little evidence of recording information as it was completed. Or analysis on the board has no support in the notebook 2=Some evidence of recording information as it was completed. Some evidence of analysis is included, but not all calculations/analysis are shown in notebook. 4=Daily work was recorded as it happened. The data is recorded in raw format in an organized manner. All trials are recorded and relate to the board. 6= Daily work was recorded as it happened. The data is recorded in raw format in an organized manner. All trials are recorded and relate to the board. Both raw data and written observations are recorded. Evidence of multiple trials is clearly evident. 8=Detailed, well written, and organized, includes all of the above and in-depth analysis and reflection of the project.	
Overall Quality To what degree does this project relate to broader scientific principles and real world applications, is original or has an innovative approach to the topic or shows a high degree of complexity.	0=Very little degree of originality and or just repeating of something they found. 2=Some relevance to real world application but low degree of originality or complexity. 4=Some originality (changing a variable or two), or complexity, may relate to real world yet not identified by the student. 6=A degree of originality, complexity, and has real world application to broader scientific principles and innovative. 8=Very innovative and original. Complexity and application to broader scientific principles is high.	
	Subtotal back	
	TOTAL POINTS _____ / 68	

SJCSEF Rubric **ENGINEERING**

Please circle: 3-5 6-8 9-12

Project #	**Judges Initials:**
Project Title:	

Abstract To what degree does the abstract describe the project? (Maximum of 250 words)	0=No abstract. 1=Poorly written and does not describe the project. 2=Poorly written and does not describe all components of the project. 3=Well written but does not describe all components of the project. 4=Well written and completely describes the project.	*Points*
Define A Problem Or Need The purpose is clearly and succinctly stated. It may be an improvement or a new design.	0=No need or problem is stated. 2=Poorly written Problem Statement or unclear focus. 4= Well-stated problem or need however approach to the design taken from a source. 6=Original and unique project that addresses or solves a real need and has a good approach. Clear logical objective that is succinctly stated.	
Background Research- Research should show that the student has acquired new knowledge about the nature of the problem and what others have done on similar problems.	0=No evidence of investigation or research. 1=Minimal evidence of research. 2=Some research with evidence of reading about the problem but lacking depth, (minimal sources cited or information used to guide work). 3=Good background research, however student does not fully apply found knowledge to his or her project (multiple sources are used). 4=Good research and evidence that student has used new knowledge as the foundation to move in a new direction (multiple sources used).	
Design / Criteria Design criteria are requirements that the student specifies that will guide the development of the design.	0=No design criteria or specifications of design listed. 2=Poor design criteria or constraints outlined. 4=Minimal design criteria may be incomplete in scope or constraints. 6=Complete design criteria outlined, design is clear and constrains are clearly outlined.	
Prepare Preliminary Designs Does the student clearly understand the design that was developed and used? Does the student consider multiple solutions?	0=No initial design provided. 2=No iteration of the design process is considered and some sketches are evident. 4=Multiple iterations of the design solutions are considered. Sketches, models and dimensional drawings are shown. 6=Multiple solutions are generated and alternatives seriously considered. Criteria for rejecting alternatives are well stated and used. Quality sketches, models, and two-dimensional drawings are evident and their use is apparent.	
Build, Test And Retest A Prototype Students will need to test and retest their design noting any adjustments and making design changes as needed.	0=No test or prototype evident. 2=A prototype has been created yet tested only a minimal number of times. 4=The prototype has been tested multiple times however adjustments and changes are not made. 6=The prototype has been tested multiple times and adjustments and changes have been noted and logical corrections made.	
	Subtotal front	

SJCSEF Rubric **ENGINEERING** Please circle: 3-5 6-8 9-12

Analysis And Evaluation Of The Design To what degree does has the design been developed	0=No written narrative or analysis or evaluation. 2=Analysis of design may not be logical or may not mention the criteria used for success. 4=Analysis of the design solution is logical and there is some mention of economic and ecological feasibility. 6=Analysis is logical and there is good analysis of economical and ecological feasibility and or scale in the application of the design solution.	
Notebook The development of problem/need is evident at the beginning of the journal. It continues to explain the engineering goals and what is being tested. Sketches, models and diagrams are evident. Design criteria and redesigning adjustments are noted. There is an on going record of the tests and it shows analysis, reflection and application.	0=Little evidence of recording information as it was completed. Or analysis on the board has no support in the notebook 2=Some evidence of recording information as it was completed. Some evidence of analysis is included, but not all calculations/analysis are shown in notebook. 4=Daily work was recorded as it happened. The data is recorded in raw format in an organized manner. All trials are recorded and relate to the board. 6= Daily work was recorded as it happened. The data is recorded in raw format in an organized manner. All trials are recorded and relate to the board. Both raw data and written observations are recorded. Evidence of multiple trials is clearly evident. 8=Detailed, well written, and organized, includes all of the above and in-depth analysis and reflection of the project.	
Display Attributes Attractive, clear, legible and in appropriate order. Workmanship on the design is thorough and attention to detail is noted.	0=Unsatisfactory display – attributes missing. 1=Poor quality of display with little attention to detail. 2=Average quality but board organization hinders communication. 3=Good quality – but the addition of more components would improve communication or layout hinders communication. 4=Superior display – layout and organization facilitates communication.	
Overall Quality To what degree does this project relate to broader scientific principles and real world applications, is original or has an innovative approach to the topic or shows a high degree of complexity.	0=Very little degree of originality and just building from found directions. 2=Some relevance to real world application but low degree of originality or complexity. 4=Some originality (changing a variable or two), or complexity, may relate to real world yet not identified by the student. 6=A degree of originality, complexity, and has real world application to broader scientific principles and innovative. 8=Very innovative and original. Complexity and application to broader scientific principles is high.	
	Subtotal back	
	TOTAL POINTS _____ / 58	

SJCSEF Rubric **MATHMATICS/COMPUTER SCIENCE** Please circle 3-5 6-8 9-12

Project #	**Judges Initials:**
Project Title:	

		Points
Abstract To what degree does the abstract describe the project? (Maximum of 250 words)	0=No abstract. 1=Poorly written and does not describe the project. 2=Poorly written and does not describe all components of the project. 3=Well-written but does not describe all components of the project. 4=Well-written and completely describes the project.	
Problem/Need The purpose is clearly and succinctly stated? The computer usage represents a new point of view or improvement on an older version of a program.	0= No problem / need to solve. 1= Poor problem or no objective. 2=Unoriginal problem, however creative approach to the idea. 3=Shows insight and addresses a need. Well thought out objective. 4=Original and unique project that addresses or solves a real need and has a good approach. Clear logical objective succinctly stated.	
Experimental Design/Criteria Design criteria are requirements that the student specifies that will help the student develop his or her software and determine the extent to which the final production/ program meets the state design goal.	0=No evidence of design criteria listed. 1=Poor quality design, and does not follow a logical progression. 2=Minimal quality, additional testing may not be done or illogical solution or software/programming may be incomplete to meet the goal. 3=Average quality, identifies the requirement, and has a solution. 4=Exemplary quality, requirements are stated, design is clear, development and testing is accurate and retesting is done to ensure accurate solution.	
Preliminary Designs Does the student clearly understand the procedure and can accurately conduct the procedure using the plans that were developed and used?	0=No structured process shown. 1=Incomplete iteration of code. 2=Complete iteration of a code. 3=Multiple iterations written to achieve the same goal. 4=Entire software development life cycle is clearly evident including plans that match the requirements and results from testing and computing.	
Test Student will test the code and should note any bugs in the program, slow parts in the code, the most efficient parts of the code, etc. A "test plan" is a key part of the testing process.	0=No testing of the code is indicated. 1=Test is done but notes about bugs or successes are not made. 2=Testing is done and bugs are noted. Slow parts or strengths not evident. 3=Testing is done and bugs, strengths, and slow parts are noted. 4=Testing is done and the above is noted, in addition, a "test plan" is a well written, key part of the process.	
Redesign and Retest This is the longest step of the engineering design process. Debugging, rewriting and optimizing the code is done. Conduct several different tests of the code and use failure analysis, the state design criteria and design goal to guide revision.	0=No retesting is evident. 2=Retesting is evident however logical connections aren't made. 4=Retesting is evident and debugging is evident. 6=Retesting and debugging is evident and deletions and additions are evident. 8=Retesting, redesigning, debugging, optimizing are done until the design criteria has been reached and the design goal has been clearly fulfilled.	
	Subtotal	

Conclusion To what degree are the conclusions recognized and interpreted? Conclusions are logical and based on collected data. Students show unanswered questions may remain. Mathematical symbols or computer program readouts are standard or carefully explained.	0=There isn't a conclusion. 1=The conclusion is illogical and not based on collected data. There isn't any explanation of mathematical symbols or program. 2=The conclusion is weak and does not address all aspects of the project. There aren't any further questions or explanations. 3=The conclusion supports the collected data and relates whether there are still unanswered questions. Some mathematical symbols or programming techniques are explained. 4=The conclusion is a well-written interpretation of data, major findings are addressed and further tests are cited. Computer program readouts are clearly explained.	
Display Attributes Attractive, clear, legible and in appropriate order.	0=Unsatisfactory display – attributes missing. 1=Poor quality of display with little attention to detail. 2=Average quality but board organization hinders communication. 3=Good quality – but the addition of more components would improve communication or layout hinders communication. 4=Superior display – layout and organization facilitates communication.	
Overall Quality To what degree does this project relate to broader scientific principles and real world applications, is original or has an innovative approach to the topic or shows a high degree of complexity. Student shows deep understanding of concepts.	0=Very little degree of originality and/or complexity. 1=Some relevance to real world application but low degree of originality or complexity. 2=Some originality or complexity, may or may not have real world application, yet not identified by the student. 3=A degree of originality, complexity, and has real world application and is innovative. 4=Very innovative and original. Complexity and application is high. The study is complete and shows a deep understanding.	
Notebook The development of problem/question is evident at the beginning of the journal. All original calculations or computer programs are shown in detail. Listed are the results or multiple trials and comments on the procedure. There is an on-going record of the experiment and shows analysis, reflection and application.	0=Little evidence of recording information as it was completed. Or analysis on the board has no support in the notebook 2=Some evidence of recording information as it was completed. Some evidence of analysis is included, but not all calculations/analysis are shown in notebook. 4=Daily work was recorded as it happened. The data is recorded in raw format in an organized manner. All trials are recorded and relate to the board. 6= Daily work was recorded as it happened. The data is recorded in raw format in an organized manner. All trials are recorded and relate to the board. Both raw data and written observations are recorded. Evidence of multiple trials is clearly evident. 8=Detailed, well written, and organized, includes all of the above and in-depth analysis and reflection of the project.	
	TOTAL POINTS _____ / 44	