

# COMPUTER-AIDED DESIGN (CAD), ENGINEERING



## OVERVIEW

Participants have the opportunity to use complex computer graphic skills, tools, and processes to develop three (3)-dimensional representations of engineering subjects such as a machine part, tool, device, or manufactured product.

## ELIGIBILITY

Two (2) individuals per state may participate. Participants may compete in either CAD, Architecture or CAD, Engineering, not both events.

## TIME LIMITS

1. Forty-five (45) minutes is allowed for set-up time.
2. Four (4) hours is allowed for participants to develop drawing(s).
3. One (1) hour is allotted for the final evaluation.
4. All individuals will participate in a LEAP interview that will last a maximum of five (5) minutes.

## LEAP

An individual LEAP Report is required for this event and must be submitted at event check-in (see LEAP Program).

## ATTIRE

TSA competition attire is required for this event.

## PROCEDURE

1. Participants bring their own computer systems (see Regulation A) to the event area at the time and place stated in the conference program.
2. Participants must submit a LEAP Report prior to receiving the design problem.
3. Each participant, with one (1) assistant (an instructor, fellow student, or adult chaperone), is allowed to set up and test the equipment. At the end of the forty-five (45)-minute set-up period, assistants are required to leave the area.
4. Participants are given a design problem to solve in a four (4)-hour work session.

5. Participants work independently, without assistance from judges, teachers, fellow participants, other students, or observers.
6. Participants are advised to save their work on their hard drives every fifteen (15) minutes.
7. At the end of the session, participants save their work on their hard drives and on a USB flash drive.
8. One (1) additional hour is spent interviewing the participants and evaluating the entries from each participant's computer monitor.
9. The LEAP interview will be conducted as part of the event-specific interview.
10. A list of twelve (12) semifinalist teams (in random order) will be posted.
11. Participants report to the event area at the time and place stated by in the conference program to pick up their equipment.
12. The top ten (10) finalists will be announced during the award ceremony.

## REGULATIONS

- A. Participants provide their own systems, including
  1. hardware (only one [1] CPU and one [1] monitor), capable of reading a USB flash drive; laptops are recommended
  2. software
  3. one (1) USB flash drive
  4. power strip/surge protector
  5. reference materials
- B. A table, chair, sketching paper, and electricity will be supplied for each participant.
- C. Participants are required to provide their own pencils.
- D. Participants are not permitted to share solutions to problems, reference materials, hardware, or software.
- E. Participants identify their work using only their student identification number.
- F. USB flash drives, and the work they contain, become the property of TSA.

### G. The LEAP Report

1. Participants document the leadership skills developed and demonstrated while working on this event, and on a non-competitive event leadership experience.
2. Participants will respond to questions about the content of the LEAP Report as part of the LEAP interview, which will be conducted as part of event-specific interview.
3. Specific LEAP Report regulations can be found in the LEAP Program section of this guide and on the TSA website.

### EVALUATION

1. Entries are evaluated on screen according to the criteria on the official rating form.
2. The LEAP requirements and interview will also be evaluated.

Refer to the official rating form for more information.

### STEM INTEGRATION

This event aligns with the STEM educational standards of Science, Technology, Engineering, and Mathematics.

### CAREERS RELATED TO THIS EVENT

- Engineer
- Automobile designer
- CAD professional
- Machine designer

# CAD, ENGINEERING

## 2019 & 2020 OFFICIAL RATING FORM

### HIGH SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an “adequate” score of 7 for an X1 criterion = 7 points; an “adequate” score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

**Go/No Go Specifications**

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

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Completed LEAP Report is present.

ENTRY NOT EVALUATED

SOLUTION TO PROBLEM (40 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
<b>Design</b> (X1)	The layout and design of the drawing as presented do not create an effective model for the problem assigned.	The layout and design of the drawing as presented are somewhat effective in modeling the problem assigned.	The layout and design of the drawing completely and effectively model the problem assigned.	
<b>Functionality</b> (X1)	The design as drawn lacks order of direction and is impractical.	The design is somewhat practical in directional flow and overall organization.	The design is completely effective, practical, and functional.	
<b>Originality</b> (X1)	The design drawing provides no quality of newness or deviation from tradition.	The design drawing shows some attempt to be creative and less non-traditional.	The design drawing provides a unique and creative quality of newness that departs from tradition.	
<b>Aesthetics</b> (X1)	The design is unappealing and fails to capture the observer’s attention.	The design is somewhat pleasing and appealing and attempts to capture the observer’s attention.	The design as drawn is pleasing and appealing and effectively draws attention to its appearance/beauty.	
<b>SOLUTION TO PROBLEM SUBTOTAL (40 points)</b>				

LAYOUT (60 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
<b>Correct geometry</b> (X2)	The correct views and orientation have not been selected or used throughout the drawing process and final layout.	Most of the views and orientation selected and used are correct and in the proper layout format.	All of the views and orientation that have been selected and used are correct and in the proper layout.	
<b>Detailing</b> (X1)	Many of the details are missing or placed incorrectly.	Most of the details are included and are correctly placed.	All necessary details are included and are placed correctly.	

LAYOUT (60 points) – continued				
<b>Lettering</b> (X1)	The choice of font style, size, color, and application is inappropriate for the drawing assignment.	The choice of font style, size, color, and application is appropriate, with few inconsistencies/variations.	The choice of appropriate font style, size, color, and application is clearly evident and applied consistently.	
<b>Dimensioning</b> (X1)	Many of the necessary dimensions are missing and/or placed incorrectly.	Most of the required dimensions are included and placed correctly.	All of the necessary dimensions are included and correctly placed.	
<b>Scale</b> (X1)	The scale selected for the drawings is incorrect and not properly noted.	The scale selected for most aspects of the drawings is correct and properly noted.	The scale selected for all aspects of the drawings is correct and properly noted.	
<b>LAYOUT SUBTOTAL (60 points)</b>				

ENGINEERING APPLICATION (20 points)				
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
<b>Application of practices</b> (X1)	Many, if not most, of the engineering practices selected and used are incorrectly applied.	Most of the engineering practices selected and used are correctly applied.	All of the engineering practices selected and used are correctly and appropriately applied.	Record scores in the column spaces below.
<b>Appropriate use of conventions</b> (X1)	There is little or no evidence of an effective application of engineering conventions in the completed design and drawings.	There is some evidence of an effective application of engineering conventions in the completed design and drawings.	There is clear evidence of an effective and knowledgeable application of engineering conventions in the completed design and drawings.	
<b>ENGINEERING APPLICATION SUBTOTAL (20 points)</b>				

SOFTWARE UTILIZATION (20 points)				
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
<b>CAD functions</b> (X1)	There is little evidence of an understanding and application of CAD functions.	There is evidence of a general understanding and effective application of CAD functions.	A complete and effective understanding and application of CAD functions is evident.	Record scores in the column spaces below.
<b>CAD features</b> (X1)	There is little evidence of understanding and application of CAD special features.	There is a general understanding and application of CAD special features.	There is complete understanding and application of the various special features of CAD.	
<b>SOFTWARE UTILIZATION SUBTOTAL (20 points)</b>				

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: \_\_\_\_\_

<b>SEMIFINAL LEAP INTERVIEW (14 points)</b>			
<b>CRITERIA</b>	Minimal performance	Adequate performance	Exemplary performance
	1-4 points	5-8 points	9-10 points
<b>LEAP Report/ Interview</b> (10% of the total event points)	The individual's efforts are not clearly communicated, lack detail, and/or are unconvincing; few, if any, attempts are made to identify and/or incorporate the SLC Practices and Behaviors.	The individual's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the SLC Practices and Behaviors is adequate.	The individual's efforts are clearly communicated, fully-detailed, and convincing; identification and/or incorporation of the SLC Practices and Behaviors is excellent.
<b>SEMIFINAL LEAP INTERVIEW SUBTOTAL (14 points)</b>			

Record scores in the column spaces below.


**To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. TOTAL (154 points)**

Comments:

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I certify these results to be true and accurate to the best of my knowledge.

**JUDGE**

Printed name: \_\_\_\_\_ Signature: \_\_\_\_\_

# COMPUTER-AIDED DESIGN (CAD), ENGINEERING EVENT COORDINATOR INSTRUCTIONS

## PERSONNEL

- A. Event coordinator
- B. Judges, two (2) or more
- C. Assistants, one (1)

## MATERIALS

- A. Coordinator's packet, containing:
  - 1. Event guidelines, one (1) copy for the coordinator and for each judge
  - 2. TSA Event Coordinator Report
  - 3. List of judges/assistants
  - 4. Pre-populated flash drives for judges
  - 5. Stick-on labels for entries, as needed
  - 6. Results envelope
  - 7. Envelope for LEAP Reports
  - 8. LEAP Interview Judging Protocol
- B. Tables and chairs for competitors and judges
- C. One (1) ream of 8½" x 11" white copier paper
- D. Statement of problem as a hard-copy sketch, pages as needed.

## RESPONSIBILITIES

### AT THE CONFERENCE

- 1. Attend the mandatory coordinator's meeting at the designated time and location.
- 2. Report to the CRC room and check the contents of the coordinator's packet.
- 3. Review the event guidelines and check to see that enough judges/assistants have been scheduled.
- 4. Inspect the area(s) in which the event is to be held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
- 5. At least one (1) hour before the event is to begin, meet with judges to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.

### PRELIMINARY/SEMIFINAL ROUND

- 1. As participants arrive, check the coordinator's report and assign participants to work stations.
- 2. Collect LEAP Reports.
- 3. All participants and judges should be in the room at this time.
- 4. Anyone reporting who is not on the coordinator's report may check in only after official notification is received from the CRC.
- 5. Late entries are considered on a case-by-case basis and only when the delay is caused by events beyond participant control.
- 6. Allow forty-five (45) minutes for participants and their assistants (no more than one [1] per participant) to set up equipment.
- 7. At the end of the forty-five (45)-minute set-up time, non-participants are required to leave the event area.
- 8. Review with the participants the time limits, procedures, regulations, and protocol of the event.
- 9. Remind participants to save their work at regular time intervals.
- 10. Distribute copies of the CAD problem. Answer any appropriate questions concerning the problem.
- 11. Begin the event and announce the ending time.
- 12. During the event, the judges and assistants monitor and evaluate participant progress and work.
- 13. Announce the time remaining to work at one (1) hour, thirty (30) minutes, fifteen (15) minutes, and five (5) minutes before time is called.
- 14. When time is called, participants stop and save their work on their hard drives and on their USB flash drives.
- 15. Collect the entries, checking to be sure each one is labeled with the student's identification number.
- 16. Participants remain at their computers for up to one (1) hour as evaluation of the entries is completed.

17. Conduct semifinalist LEAP interviews. Interviews should be a maximum of five (5) minutes in length.
18. Judges independently assess the entries.
19. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either:
  - a. To deduct twenty percent (20%) of the total possible points in this round or
  - b. To disqualify the entry
  - c. The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
20. Judges determine the twelve (12) semifinalists and ten (10) finalists, and discuss and break any ties. (Determine the procedure for breaking ties before the onsite competition begins.)
21. Submit semifinalist and finalist results and all related forms in the results envelope to the CRC room.
22. If necessary, manage security and the removal of materials from the area.