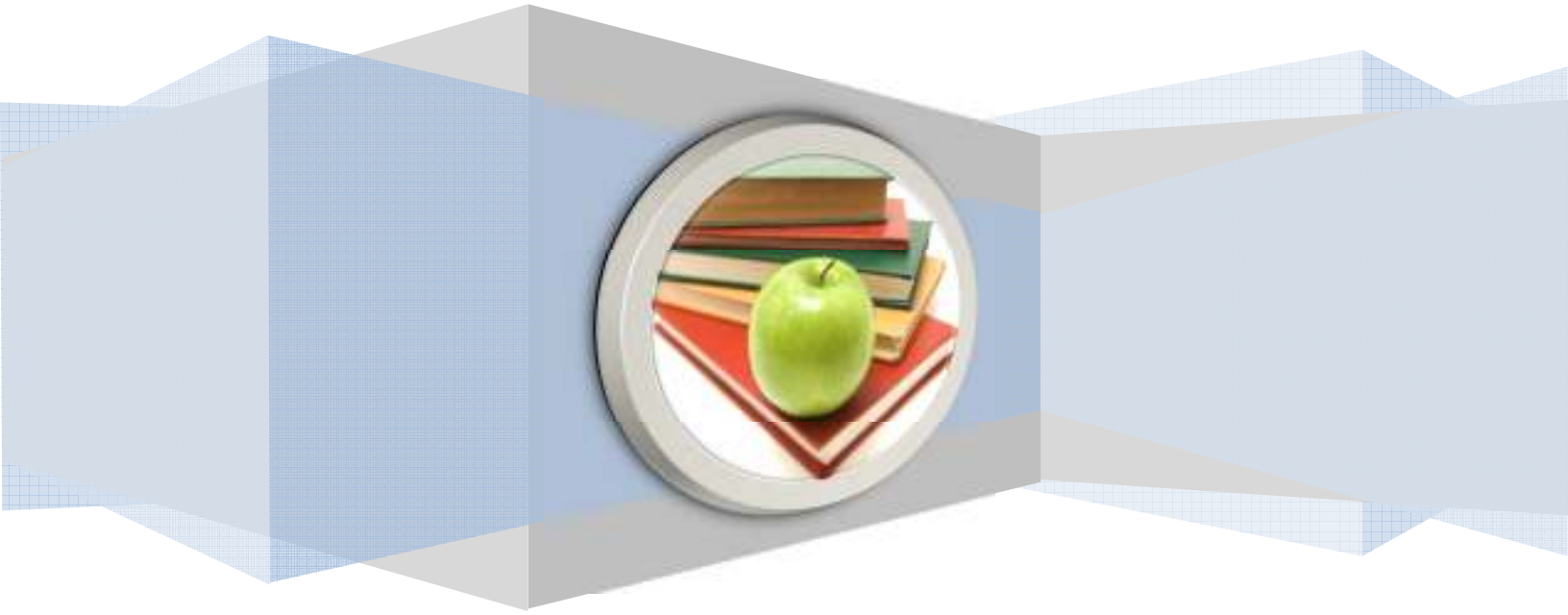
APPENDIX B3

A+ (ADVANCED STEM) PROGRAM

1. A+ Overview
2. A+ Brochure
3. A+ Junior Curriculum
4. A+ Junior Guidelines
5. A+ Math Coach Handbook
6. A+ Computer Science Coach Handbook

ACCORD INSTITUTE
For Education Research

A+ Program Overview



WHY A+ PROGRAM?

In 2007, National Academies published a report , Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future, identifying the urgent need to increase the number of Science and Technology graduates within the next decade. The report's conclusions are serious, noting that there is a serious risk that the United States may soon and irrevocably lose its lead in science and technology. Among the recommendations of the report is:

"Vastly improve K-12 science and math education"

In its biannual publication, *Indicators* the National Science Board drew the US public's attention to the increasing shortage of qualified science and engineering (S&E) personnel in the workforce. The 2004 issue emphasized the following serious problems:

- The number of jobs requiring S&E skills in the U.S. is growing at a rate of almost 5 percent per year. In contrast, the growth rate of other jobs is just over 1 percent.

- Between 1990 and 2000 the percentage of foreign-born people with bachelor's degrees in S&E occupations rose from 11 to 17 percent; the percentage of foreign-born with master's degrees rose from 19 to 29 percent; and the percentage of foreign-born with PhDs in the S&E labor force rose from 24 to 38 percent.

- Visas for students and S&E workers have been issued more slowly since the events of September 11, owing to both increased security restrictions and a drop in applications.

- Since the 1980s other countries have increased investment in S&E education and the S&E workforce at higher rates than the United States. Between 1993 and 1997 the OECD countries increased their number of S&E research jobs by 23 percent, more than double the 11 percent increase in S&E research jobs in the United States.

There is a great need to inspire and encourage students in the United States to pursue careers in science and engineering. In addition, according to reports prepared by the National Association for Gifted Children (NAGC), there are approximately 3 million academically gifted children in grades K-12 in the U.S --approximately 6% of the student population. The NACG emphasized that gifted students are in need of services or activities not normally provided by schools. However, the federal government does not provide specific funding for gifted education directly to districts. The reports also pointed out the missed opportunities to identify and serve gifted students in the U.S.

Program Description

The A+ Program is Accord Institute's unique program for grades K-12 that aims to increase talented students' interest in and advanced study of math and science.

Early math and science training by experts ensures that students have the background they need for higher education and careers in math and science. A+ is a concentrated training program that helps students develop their critical and analytical thinking skills within a challenging environment. Specifically, A+ utilizes prestigious math and science competitions at regional, national and international levels to motivate and train students. Some of these competitions are:

- International Mathematics Olympiad (IMO)
- International Olympiad in Informatics (IOI)
- USA Math Olympiads (USAMO)
- USA Computing Olympiads (USACO)
- American Mathematics Competitions (AMC-8, AMC-10, AMC-12, AIME)
- MathCounts
- Math League
- Math Olympiads for Elementary and Middle Schools (MOEMS)
- Gauss League (Accord Institute's Math Competition)
- ACCompete (Accord Institute's Computer Science Competition)
- MathMatters

Goals of A+

The goals of A+ Program are to:

- Enrich students with a more challenging curriculum in the sciences
- Cultivate an interest in math, science, and technology related fields
- Provide essential resources and tools for students to excel and reach their full potential
- Create a challenging environment for students via a regional, competitive ranking system and A+ camps
- Empower students to succeed in secondary and post secondary education
- Contribute to meeting our nations' and world's future needs by preparing skilled and dedicated citizens
- Groom qualified scientists for our community and our nation

Accord Institute's A+ Team

Fatih Gelgi, Ph.D. (A+ Program Coordinator)

Fatih Gelgi received his Ph.D. in Computer Science in 2007 from the Arizona State University. Dr. Gelgi won bronze medal in the International Olympiads in Informatics (IOI'99). He has been training computer olympiad students for more than a decade. Currently, he serves as the A+ Program Coordinator as well as the Computer Science Coordinator at Accord Institute. He is also a coach of USA Computing Olympiad (USACO) through which the American team for the International Olympiad in Informatics is chosen and trained.

Mehmet Kaysi (Math Coach)

Mehmet Kaysi received has B.S. degree in Mathematics. He participated in IMO'04 as a high school student. He has been training math olympiad student for five years from beginning to international levels. He served as one of the Turkish National Math Team coaches between 2004 and 2009.

Ali Gurel, Ph.D. (Math Coordinator)

Ali Gurel received his Ph.D. from California Institute of Technology (Caltech) Math Department. He won a silver medal at the International Mathematics Olympiads (IMO'96). He has been training math olympiad students for more than a decade. He trained Zarathustra Brady, a gold medalist (IMO'06), Tedrick Leung a bronze medalist (IMO'07), and David Yang a USAMO Winner (2009) on advanced math subjects. Currently, he serves as the math coordinator of Accord Institute's A+ team and one of the coaches of the Math Olympiad Program (MOP) through which the American team for the International Math Olympiads is chosen and trained.

Benefits of A+

Participation in the Accord Institute's A+ Program benefits students and schools both academically and socially. The advantages include the following:

- Team spirit
- Increased interest in science and mathematics
- Creative problem solving strategies
- Improved self-confidence
- Immediate support for students' weak areas
- A challenging environment for students
- Disciplined study habits
- Constructive and productive investment of time
- A solid background in advanced math, computer and science concepts
- Mastery of the scientific method
- Early and confident decision-making to pursue careers in math and science
- Accurate, grade-level, student ranking in math and computers based on exams taken by students in all member schools
- Recognition for success at prestigious competitions
- An exceptional accomplishment that top ranked universities are looking for

A+ Camps

A+ camps consist of advanced topics covered by experts and aim to increase student motivation during the year. Each year students can look forward to:

- 4 school camps
- 2 regional camps
- 2 national camps

All camps follow A+ Camp Guidelines. Camp programs, schedules, and lecture materials are carefully selected by the Accord Institute with student interests in mind: educational and motivational movies, math and science games, and team building activities.

All students participate in school sleepovers, which are organized by the A+ school coordinator. Sleepovers last only one day, from Friday evening until Saturday evening.

Regional and national camps are by invitation. Students are selected based on their test scores, assignments, effort, and behavior. Regional camps last two-days and are organized by the A+ school coordinators in that region. They are from Friday evening until Sunday noon. Currently, A+ camps are organized in four regions: Arizona, Utah-Colorado, Nevada, and California. In the winter and summer, students are invited from all the regions to participate in one-week national camps. Outstanding academician and professionals are invited to these national camps as guest speakers.

Questions about camps should be directed to the A+ school coordinator.

Parent Involvement

A+ staff and parents work as a team. A+ is a proven effective system. However, students' individual level of success depends heavily on parental support and involvement. Many interests and diversions compete for adolescents' time. We ask parents to help make A+ a priority for their son/daughter. The most successful students have highly committed parents.

We value your input and recommendations. Please respond to camp surveys.

FACTS: MATH, SCIENCE EDUCATION AND GIFTED STUDENTS IN THE U.S.

In 2007, National Academies published a report that identifies the urgent need to increase the number of Science and Technology graduates within the next decade. Otherwise, there is a serious risk that *the U.S. may soon and irrevocably lose its lead in science and technology*. It is strongly recommended to vastly improve K-12 science and math education.

according to reports prepared by the National Association for Gifted Children (NAGC), there are approximately 3 million academically gifted children in grades K-12 in the U.S, approximately 6% of the student population. The NACG emphasized that *gifted students are in need of services or activities not normally provided by schools*. However, the federal government does not provide specific funding for gifted education directly to districts. The reports also pointed out the missed opportunities to identify and serve gifted students in the U.S.

Thousands of geniuses live and die undiscovered - either by themselves or by others.

Mark Twain

A+ TEAM

FATIH GELGI, PH.D. (A+ PROGRAM COORDINATOR)

Fatih Gelgi received his Ph.D. in Computer Science in 2007 from the Arizona State University. Dr. Gelgi won bronze medal in the International Olympiads in Informatics in 1999 (IOI'99). He has been training computer olympiad students for more than 10 years. He is also a coach of USA Computing Olympiad (USACO) through which the American team for the International Olympiad in Informatics is chosen and trained.

ALI ERDEM ERSOZ (A+ MATH COORDINATOR)

Ali E. Ersoz received his B.S. in teaching mathematics. He worked as a math teacher for 20 years. He has been an A+ Math Coach for 10 years. He took the leadership role on the A+ problem writing committee and prepared several problems that appeared at math contests such as MathMatters.

ALI GUREL, PH.D. (A+ MATH COACH)

Ali Gurel received his Ph.D. from California Institute of Technology (Caltech) Math Department. He won a silver medal at the International Mathematics Olympiads in 1996 (IMO'96). He has been training math olympiad students for more than 12 years. He trained Zarathustra Brady gold medalist of the IMO'06 and David Yang gold medalist of IMO'11 and IMO'12. He also serves as one of the coaches of the Math Olympiad Summer Program (MOP) through which the American team for the International Math Olympiads is chosen and trained.

MEHMET KAYSI (A+ MATH COACH)

Mehmet Kaysi has B.S. degree in Mathematics. He participated International Mathematics Olympiads (IMO) in 2004 as a high school student. He has been training math olympiad students for 5 years from beginner to international levels.

IBRAHIM BAYRAKTAR (A+ SCIENCE COORDINATOR)

Ibrahim Bayraktar has B.S. degree in Biology. He taught biology at middle and high school classes for more than 10 years. Beside teaching science, he has been organizing science competitions, camps, field study programs to foster more student interest in science.

ACCORD INSTITUTE For Education Research

http://www.accordeducation.org

A+ PROGRAM

Advanced Science, Technology, Engineering, and Math Program

ACCORD INSTITUTE'S A+ PROGRAM

WHAT IS A+ PROGRAM ?

A+ Program is a unique and rigorous advanced Science, Technology, Engineering and Math (STEM) program offered to students in grades 4-12. Participants meet regularly with experienced coaches to explore exciting, advanced topics in STEM, in preparation for prestigious competitions. It is especially designed to challenge promising students and provide them extensive experience with math, science and computer science concepts.

WHY A+ ?

In the United States today, the growth rate of jobs in science and engineering is five times greater than the growth rate of jobs overall. Simultaneously, schools are inadequately identifying and serving academically gifted students. Taken together, it is clear that U.S. schools hold the key to better motivating talented students to pursue careers in STEM. A+ is the dynamic program developed for this purpose.

BENEFITS OF A+

- ✓ Team spirit
- ✓ Increased interest in science and mathematics
- ✓ Creative problem solving strategies
- ✓ Improved self-confidence
- ✓ Immediate support for students' weak areas
- ✓ A challenging environment for students
- ✓ Disciplined study habits
- ✓ Constructive and productive investment of time
- ✓ A solid background in advanced math, computer and science concepts
- ✓ Mastery of the scientific method
- ✓ Early and confident decision-making to pursue careers in math and science
- ✓ Accurate, grade-level, student ranking in math and computers based on exams taken by students in all member schools
- ✓ Recognition for success at prestigious competitions
- ✓ An exceptional accomplishment that top ranked universities are looking for

It was a great experience to teach A+ classes. This program ensures that talented students learn the higher level thinking skills and concepts they will need in order to attain high academic success. Thank you for making this available!

Erdem E., Teacher

GOALS OF A+

- ✓ Enrich students with a more challenging curriculum in the sciences
- ✓ Cultivate an interest in STEM related fields
- ✓ Provide essential resources and tools for students to excel and reach their full potential
- ✓ Create a challenging environment for students via a regional, competitive ranking system and A+ camps
- ✓ Empower students to succeed in secondary and post secondary education
- ✓ Groom qualified scientists for our community and our nation

The winter camp marked an important turning point in my daughter's development. She was very apprehensive about going to the camp but she returned invigorated, enthusiastic, confident, and notably matured. She made new friends and became closer with her old friends. She learned plenty of math, but I think she learned even more about herself.

Denise M., Parent

A+ JUNIOR – CURRICULUM

For A+ Junior program, at least 3 classes per week is recommended; one class for Math Academy activities, one class for Mathematical Olympiads for Elementary and Middle Schools (MOEMS), and one class for Game Club activity.

MATH ACADEMY – MATH ACTIVITIES

Each booklet contains 4-5 activities. Each activity is for one class. It is recommended to be done one activity per week.

1. Dining Out – Explorations in Fractions, Decimals & Percents
   http://www.actuarialfoundation.org/pdf/math-academy-dining-out.pdf
2. Let's Go to the Mall – Explorations in Combinatorics
   http://www.actuarialfoundation.org/pdf/math-academy-mall.pdf
3. Are You Game? – Explorations in Probability
   http://www.actuarialfoundation.org/pdf/Math-Academy-Are-You-Game.pdf
4. Play Ball! – Explorations in Data Analysis & Statistics
   http://www.actuarialfoundation.org/pdf/math-academy-play-ball.pdf
5. Can You See It in Nature – Explorations in Patterns & Functions
   http://www.actuarialfoundation.org/pdf/math-academy-see-it.pdf

MOEMS

- Enroll MOEMS as soon as possible in the beginning of the year at http://www.moems.org/enroll.htm (due date is 09/30/2009).
- At least, one class per week is recommended.
- Monthly assignment, MOEMS problem of the month http://www.moems.org/zinger.htm.
- All students will enter the contests as a team. Contest dates for 2009-2010; November 17, December 15, January 12, February 9, and March 9.
- Follow the books:
  - Creative Problem Solving in School Mathematics 2nd Edition by Dr. George Lenchner
  - Math Olympiad Contest Problems for Elementary and Middle Schools by Dr. G. Lenchner.
  - Math Olympiad Contest Problems Volume 2 edited by Richard Kalman.

PUZZLE CLUB

The plan below contains 18 weeks; 3 weeks are optional. Instructor can choose the 15 weeks s/he wants. See 'Puzzle Handbook.pdf' for brief descriptions of puzzles.

- Puzzles (individual + group, 3 weeks)
  - Jigsaw, 100 pieces, individual competition (1st week)

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    - Jigsaw, 300 pieces, team competition (2nd week)
    - 3D, team competition (3rd week)
- Tangram (individual + group, 1 week)
- Wood, metal, chain puzzles (individual, 1 week)
- Detective, thieves & Robin Hood game (group, 3 weeks)
- Logic puzzles (individual + group, 2 weeks)
- Lateral thinking puzzles (group, 2 weeks)
- Rubik's cube (individual, 3 weeks)
    - Solving methods (3 weeks)
- Treasure hunt or a puzzle competition (school wide organization, 3 weeks)

Besides, puzzle club is responsible for running "puzzle of the week" contest (school wide).

PUZZLE OF THE WEEK CONSTEST

Puzzle club publishes "puzzle of the week"; a puzzle per week on the puzzle club bulletin, school bulletin board, and the website. These puzzles have to be solved individually. At the end of the semester top scorers (e.g. top 3 scorers) is awarded. It is recommended that a student is assigned to run the puzzle of the week. The solutions are submitted to that student.

The student will be responsible for:

- Finding the puzzles (with the help of the club teacher),
- Receiving the solutions from the solvers.
- Keeping the list of the solvers and update their scores every week.
- Providing the puzzle, last week's answer, list of the top scorers (e.g. top-20 scorers in the school) and his/her contact information to the publicity officer and the webmaster to publish the puzzle to the puzzle club bulletin, school bulletin board, and the website.

The puzzles can be found at the websites (this list mustn't be uncovered to the students; that spoils the contest):

- Logical Problems, http://www.folj.com/puzzles/
- Brain Food, http://www.rinkworks.com/brainfood/
- AIMS Puzzle Corner, http://www.aimsedu.org/Puzzle/index.html

TREASURE HUNT

The treasure hunt game is an activity that can be organized in the school building. 4-5 people teams try to find the clues or puzzles hidden in different places in the school. After finding the clue, a team proceeds to the next possible clue location using the current clue. At the end of the clues, team finds the treasure. The first team that finds the treasure in a certain time period wins the game. Treasure hunts are very enjoyable by students. They can be one of the best fun activities in the schools; improves social skills and team spirit in the school. Entrance fee can be collected (ex. $10 per team) so it won't have any cost to the club. For treasure hunt ideas and guidelines check:

- Treasure hunt ideas, http://www.creativekidsathome.com/activities/activity_28.html
- Make your own treasure hunt, http://www.creativekidsathome.com/activities/activity_147.shtml

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PUZZLE COMPETITION

Puzzle competition is organized school wide. It can also be organized as a Puzzle Night involving the families. The competition can be either individuals, teams, or both parts. It can be composed of all the puzzles in the curriculum. The individual/team gets the highest score wins the competition.

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A+ JUNIOR – GUIDELINES

OVERVIEW

A+ Junior is a preparatory program for A+ Program in elementary school, 4th and 5th grades. In the elementary school, the goals of A+ Junior program are:

- To provide enthusiasm for math and science,
- To warm-up students for the academic discipline and studying,
- To train the students toward MOEMS competition,
- To provide joyful time with math activities,
- To improve problem solving and analytical reasoning skills.

CLASSROOM SETUP & IMPLEMENTATION

GENERAL SETUP

- **Maximum number of students**: 24
- At least, 3 classes per week is recommended; one class Math Academy activities, one class Mathematical Olympiads for Elementary and Middle Schools (MOEMS), and one class Puzzle Club activity.
- **Publicity**
    - Fliers & posters
        - Use readable lettering
        - Post fliers on bulletin boards, ask other teachers to put them up, and leave some at the library and the main office.
    - Website
        - Announce club activities, student achievements, member lists, and top puzzle ratings in the club and in the school etc.
    - News releases
        - School newspaper, yearbooks
        - Club newsletter
- **A+ Junior membership**
    - Ask A+ Program Coordinator for A-STEM CMS account
    - Enroll your students in A-STEM CMS
- Bulletin board
    - Weekly "Puzzle of the Week", throughout the semester
        - May have cheap entry fee
        - Prizes for top scorers
    - Top puzzle solvers' list
    - Activity photos
- Individual, group and school wide puzzles.

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- Enroll MOEMS as soon as possible at the beginning of the year at http://www.moems.org/enroll.htm (due date is **October 15, 2012**)
- Club organizes a Treasure Hunt or a Puzzle Competition
    - It should be school wide game open to everyone (e.g. including school staff may improve the spirit in the school)
    - Requires publicity to heat up student so the event flyer and participation form.
    - The game can be treasure hunt or variations such as scavenger hunt (see http://www.treasurehuntbook.com/ for details).
    - Suggested to be a team game composed of 4-5 people in each team (may be some restrictions like 'at most 1 staff per team').
    - Entrance fee can be collected (ex. $10 per team) so it won't have any cost to the club.
    - Trophies and awards are given at the end of the competition.

MATH ACADEMY

Math Academy activities included in the booklets were designed to create hands-on activities and a fun learning environment for the teaching of mathematics to students. Five booklets of Math Academy are included in the A+ Junior curriculum. See http://www.actuarialfoundation.org/programs/youth/math_academy.shtml for details.

MOEMS

Mathematical Olympiads for Elementary and Middle Schools (MOEMS) is a math competition for 4-8 graders. A+ Junior requires 4th and 5th graders to enter Elementary Division of MOEMS contest.

Created in 1977 by Dr. George Lenchner, an internationally known math educator, the Math Olympiads went public in 1979. Last year 150,000 students from 5,000 teams worldwide participated in the Olympiads. All 50 states and 25 other countries were represented. See the website for details: http://www.moems.org/index.htm.

PUZZLE CLUB

Puzzle club aims to improve students' analytical thinking and reasoning skills. The class consists of three types of activities; individual, group and school wide organized puzzles. See 'Puzzle Handbook.pdf' for puzzles information.

PREREQUISITES

- A+ placement test for all participating students (in the Courses => General section on A-STEM CMS)
- Student enrollment to A-STEM CMS
- For grades 4 and 5

COMPETITIONS

MOEMS is the targeted competition of A+ Junior Competition is briefly described below. See http://www.moems.org/contests.htm for details.

- A team may consist up to 35 students.
- 4th and 5th graders can enter only Division E (Elementary school division).

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- MOEMS have 5 monthly contests from November to March. Contest dates for 2012-2013; November 13, December 11, January 8, February 12, and March 12s.
- **Enrollment package**
    - All 25 problems and detailed solutions from the previous year. New enrollees receive 50 problems and solutions from the previous two years.
    - 5 monthly contests with detailed solutions.
    - 8 newsletters that lead the sponsor through all procedures provide statistics and relevant information.
    - Certificates for all students and awards for about 50% of all participating students and about 25% of all teams.
    - Check http://www.moems.org/enroll.htm for enrollment.
- **Contest Format**
    - Contests are taken in the participating school.
    - Each contest consists of five non-routine problems.
    - Every problem requires careful mathematical thinking and has a time limit.
    - Each student, working alone, scores 1 point for each correct answer. Thus, a student may score up to 25 points per year.
    - Calculators are not permitted.
    - When a problem introduces a more advanced concept, all necessary definitions are included.
    - The detailed solution for each problem usually names the strategy required.
    - Many solutions include follow-up problems and activities.
    - After each contest, results are submitted to us for scorekeeping. Our records will determine which awards are to be shipped after the last contest.
- For those entering scores online, the contests will be posted **one week prior** to the scheduled Olympiad date. Your password will be required to access the contest.
- **Awards**
    - *Individual*: Each participant receives a Certificate of Participation. The high scorer of each team receives a trophy. (Note: An Honorable Mention trophy is also available for purchase.) Each of the top 50% of all participants in each division receives a handsome embroidered Olympiad patch. Each of the top 10% of all participants in each division receives a silver or gold pin. Each student who achieves a perfect score of 25 points receives a bronze medallion.
    - *Team*: Each team in the top 10% of all teams receives a plaque; the next 10%, a certificate. The grade level of a team is the highest grade level of any of its members. In Division E, special certificates are awarded to the top 20% of all Grade 5 Teams and also of all Grade 4 Teams.
- Sample contests can be downloaded from http://www.moems.org/sample.htm.

EQUIPMENTS & BUDGET

- Math Academy activities
    - Booklets (free, see http://www.actuarialfoundation.org/programs/youth/math_academy.shtml or the links in the curriculum to download)
- MOEMS
    - *Books*:
        - Creative Problem Solving in School Mathematics 2nd Edition by Dr. George Lenchner.
        - Math Olympiad Contest Problems for Elementary and Middle Schools by Dr. George Lenchner.

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        - Math Olympiad Contest Problems Volume 2 edited by Richard Kalman
        - The "Problem-Solving Set" of all three volumes: ~$100. (See http://store.moems.org/mm5/merchant.mvc?Store_Code=MOEMS&Screen=CTGY&Category_Code=OLYMPIADBOOKS for details)
    - *Enrollment fee*: Online $89, Mail $99 (per team)
- Puzzle Sets (can be found at Wal-Mart, Target, Toys'R'us, Barnes & Noble)
    - Jigsaw, 100-piece (1 per students), *Price*: ~$10
    - Jigsaw, 300-piece (1 per 4 students), *Price*: ~$10
    - 3D puzzles (1 per 6 students), *Price*: ~$15, examples:
      http://puzzles.about.com/od/jigsawpuzzlesshopping/tp/3DBuildings.htm?p=1
      http://www.areyougame.com/interact/category.asp?cat=3D+Puzzles&tracking=related
    - Wood, iron, chain puzzles (1 per student), examples:
        - Accoutrements Magic Metal Puzzles (12 puzzles), *Price*: $5.90
          http://www.amazon.com/Accoutrements-Magic-Metal-Puzzles/dp/B000Q84SRC/
        - CUBE puzzle Wood with slanted corners, *Price*: $7.50
          http://www.amazon.com/CUBE-puzzle-Wood-slanted-corners/dp/B000JMCPAC
    - Tangram, examples:
        - Tangram set (1 per student)
          Learning Resources Classpack Tangrams, 4 Colors, 30/Set, *Price*: $15
          http://www.amazon.com/Learning-Resources-Classpack-Tangrams-LER0416/dp/B000VUJO1A/
        - *Recommended book*: Tangrams: 330 Puzzles, Dover Publications, 1965, *Price*: $6.95
          http://www.amazon.com/exec/obidos/ASIN/0486214834/interactivetangr
    - Rubik's Cube (1 per student), *Price*: $7.83
      http://www.amazon.com/Winning-Moves-5025-Rubiks-Cube/dp/B00081RYNC
- Detective, thieves & Robin Hood game
    - One deck of cards, *Price*: ~$5
- Organizing Treasure Hunt: ~$100 including a Treasure Hunt Set, equipments and snacks
    - Treasure Hunt Set x 1 (http://www.treasurehuntbook.com/), *Price*: ~$25
- **Initial cost**:
    - Math activities: $0
    - MOEMS books and enrollment: ~ $100 + $100 = $200
    - Puzzles: $20 per student = $600
    - Total: $800 initial cost
- **Additional yearly cost**: $100 (MOEMS enrollment fee)

ADDITIONAL RESOURCES

- Math Academy, http://www.actuarialfoundation.org/programs/youth/math_academy.shtml
- MOEMS homepage, http://www.moems.org/
- ThinkFun Game Club, http://www.thinkfungameclub.com/

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MATH COACH HANDBOOK

A+ MATH PROGRAM

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CHAPTER 1: OVERVIEW

WHAT IS A+ MATH PROGRAM?

A+ Math Program is for advanced students in middle and high schools that aim to motivate them by challenging problems in advanced math topics while training them for prestigious national and international math competitions like MathCounts, MathLeague, American Mathematics Competitions (AMC), USA Math Olympiads, and International Math Olympiads.

GOALS, BENEFITS, AND DISTINCTIVE FEATURES

The goal of A+ CS Program is to:

> *"inspire and motivate students and increase their interest and confidence in CS by training them for prestigious CS competitions".*

The benefits include learning problem solving skills, a huge plus in college applications, college-life and throughout their careers:

- The students will learn the mysteries and joys of problem solving and these skills to solve math problems which they can apply to other fields in life. Most of the science, industry, and finance jobs are based on problem solving and one who can solve math problems has the potential to solve any real life problem because math and logic is in the core of all the subjects and sciences.

One of the math competitions that the A+ students prepare for is MathCounts and statistically, MathCounts alumni students have had very high SAT scores and went to top colleges in US.

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The distinctive features of the A+ Math Program are A+ camps, learning mathematical reasoning, and improving social, team skills:

- A+ camps have problem solving classes, fun competitions, and team activities. They improve student motivation throughout the year. Students love the camps and they work hard to be selected for the following A+ regional and national camps.

The A+ Math Program is based on understanding the mathematical logic and reasoning instead of focusing on applying formulas. Many students have the misconception that math is a bunch of formulas and the more formulas you know the better you get at math. Unfortunately, math is taught to encourage this misconception in most classes and programs and because of this, many students find math boring and especially gifted students grow away from math. A+ Math Program focuses on the mathematical reasoning behind the formulas.

A third distinctive feature of the A+ Math Program is that it does not see students as problem solving machines and focuses on increasing their social, team skills which will help them throughout their life. In today's world, one cannot be successful without these important skills. A+ camps offer many team and social activities like sport activities, team games and competitions, and great social games like the famous traditional A+ camp game: 'Detective, Thieves, and Robin Hood (DTR)'. You may find more information about DTR at the Appendix.

A+ STRUCTURE

At participating schools, A+ Math Program is run by A+ School Math Coaches in coordination with the A+ School Coordinator and A+ Math Coordinator at Accord Institute.

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A+ has two major components: weekly classes and camps.

A+ math middle school component is a two-year program whose curriculum is based on advanced topics and problem solving techniques used in competitions like MathCounts and AMC-8 which are national math competitions among middle school students with around half a million students participating in each.

The curriculum has four main components: Algebra, Number Theory, Counting, and Geometry. Students learn and practice problem solving techniques with challenging and original problems in these four subjects. Past competitions, problem solving books and Accord Problem Packages are used in weekly classes and camps. The problems are not easily done using traditional methods that they learn in school which encourages them to be creative, think outside the box, and come up with original solution techniques.

The math component of A+ camps has fun math lectures and problem solving classes. In addition, students take past MathCounts competitions composed of individual, team, and countdown rounds.

CHAPTER 2: METHODOLOGY

STUDENT MOTIVATION

A+ Camps: A major component of A+ Math Program is A+ camps that aim to increase student motivation. In addition to fun lectures and problem solving hours, the camps contain several fun activities, team games and competitions to show the students the beautiful and cool sides of math.

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Non-routine problems: The problems used in weekly classes are designed to challenge students and to encourage thinking instead of asking them practice routine methods and calculations.

Make it fun: A+ classes and activities should be remembered by students as fun activities. Give points to students for solving problems. Make problems interesting by including stories in the problems about your students and their hobbies. For variables, use fun notation like apples and pears instead of the traditional boring *x, y* notation. Organize occasional individual or team competitions. Most students love to compete as teams. It is also a good idea to have food for weekly gatherings. Feel free to ask parents help for taking turns and bringing food or snacks.

Promote effort: Promote effort and hard-work rather than ingeniousness. Putting an effort and understanding only parts of the subject is much better than being smart and doing nothing. As the saying goes, a walking turtle covers more distance than a standing rabbit.

Be encouraging, set individual goals: Do not kill the math spirit of students by discouraging them because of their low scores! The exams they take are not easy ones and they have two years of preparation to reach their maximum potential. If they got 5 correct answers among 30 problems, encourage them to work hard and try increasing their score to a 7 or 8 next time.

TEACHING HOW TO LEARN

Avoid using formulas: Avoid using formulas at all costs! Instead, teach them the underlying mathematical reasoning and problem solving

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techniques. For example, if the student is asked to add up the first 100 positive integers, the traditional math makes the students memorize and apply the formula which tells them to multiply the last number, 100, with one more than that, 101, and divide the product by 2, which gives the answer 5,050.

Students, who solve the problem this way, see no beauty in math whatsoever and get bored by merely applying one formula after another without thinking. In A+ Math Program however, the student will be hinted towards seeing that these numbers can be grouped in pairs like (1, 100), (2, 99), (3, 98) and so on, so that the two numbers in each pair adds up to 101. Since we have 50 such pairs, the sum of the 100 numbers is 50 times 101, or 5,050. It is said that legendary mathematician Gauss came up with this idea in primary school when the class was asked this same problem by their busy teacher who was surprised by hearing the correct answer from Gauss in less than a minute. Students, who solve the problem using this clever method learn a clever problem solving technique, see the beauty of math and are encouraged to think and find clever ways themselves to solve challenging math problems.

IMPROVING SOCIAL, TEAM SKILLS

A+ School Team T-shirts: This would increase the team spirit among the students. When you seek or find sponsors for the program, tell them where and how in the t-shirts you would be using their logo for advertisement. Encourage the students to wear the t-shirts at math competitions and A+ camps.

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Team competitions: Include team games and activities in A+ camps. They will learn useful skills on splitting the task and working efficiently as a team, helping others, and asking help from others.

Social games: Have them play games which force them to talk to each other. Detective, thieves, and Robin Hood is a great example! It is a role playing game where they play a character and they have to talk and convince others to stay in the game. More information about the rules can be found in the Appendix. While choosing board games to play, pick ones that encourages student communication. Monopoly and Settlers of Catan are good examples.

Sports: Have outdoor activities in A+ School and Regional Camps. Team games like soccer, dodge ball, capture the flag are great examples.

PARENT INVOLVEMENT

Parent Presentation: At the beginning of the year make a parent presentation for selected students to inform the parents about the program and to invite them to participate. After regional and national camps, make a slide show using the many photos taken during the camp. Invite the parents and enjoy watching them together.

Home visits: Plan home visits earlier in the year to meet with the parents. This will help your communication with the parents throughout the year. It also gives them a chance to see how dedicated you are about their children's education.

E-mail group: Make an e-mail group with the parents. Use it for sharing news with them and giving them updates. The more direct communication channels you have with the parents, the better.

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Call them: Make occasional phone calls to talk about how the student is doing. Remind them about the upcoming A+ camps and Gauss League contests. Share good news about success of the student and the program with the parent.

Show your dedication: Let them see that you are putting a lot of effort for their kids. Dedication the power of a teacher and unlike Superman's powers, this one is not good to hide.

Ask for parent support: Do not be shy. Ask for parent support whenever needed. You are working for the future of their kids and they will love to help you! There are several ways for parent support: They can take turns to bring food to weekly gatherings or school camps, help you with transportation for the A+ camps, help you organizing an A+ bake sale or even make donations or encourage their friends or companies to make donations.

PUBLICITY

School Walls: Advertise the program in the school by showing news and pictures from the A+ camps.

Annual Presentations: Make annual presentations to school, parents, and local sponsors about the program and its success.

School Newsletter: Write or ask students, parents to write articles in the school newsletter about A+ program, events, and competitions.

A+ fundraising sales: Organize a bi-weekly or monthly A+ bake, ice-cream, cady sale. Inform the A+ parents ahead of time and ask for their help to bake and bring cookies etc. or to help selling to all the students in the school. The sales money could be used to imrove your A+ library,

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to give scholarships for successful students towards A+ National Camps etc.

CHAPTER 3: IMPLEMENTATION

OVERVIEW

A+ implementation consists of two main components: weekly classes and camps. At the beginning of every year incoming students take a placement exam to participate in A+. After the selection, the classes begin.

A+ math program requires at least 3 hours of weekly classes which follow a two-year A+ math curriculum each year consisting of 30 weeks. Classes are devoted to teaching the students problem solving techniques and equipping them with tools to solve challenging math problems. Weekly homework assignments are given to students and the homework grades based on effort and accuracy are recorded on the A+ Online Course Management System (CMS)[1] by the school CS coach.

A+ has 4 school camps, 2 regional and 2 national camps throughout the year. The schools camps are organized by school as either sleepovers or full day camps, the regional camps are organized by participating schools in a region as a weekend camp, and national camps are one-week long organized by Accord Institute.

As assessment, Accord Institute uses current and past competitions of MathCounts, AMC-8, and Gauss League. Students also take frequent

[1] A+ CMS website: http://accordeducation.org/A+/cms/.

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review exams and an evaluation exam at the beginning and in the end of the year to measure the growth-level.

A+ ONLINE COURSE MANAGEMENT SYSTEM

A+ CMS has the following features to help organizing A+ CS class at the school:

- Following up A+ reminders and events
- Student reporting, monitoring student progress, student status among all A+ students
- Easy follow-up of A+ tasks via A+ school checklist
- Course material available for download
- Online grading and attendance

For details, refer to the CMS session at Accord Institute A+' training.

STUDENT SELECTION PROCESS

A+ is an advanced program which requires certain level of mathematical skills and talent. So, only selected students may participate in the program. The goal is to have 10% to 20% of the incoming students participate in A+.

A+ School Coordinators are primarily responsible for the A+ student selection process in their schools. The selection is done in the first three weeks of the school year. The steps of A+ student selection process is as follows:

1. In the first week, A+ Placement Test downloaded from A+ CMS is given to all the incoming students and any other student who wants to join the program. A+ Coaches grade the placements test

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using automated grader downloaded from CMS. The placement test booklets are **destroyed** and all the student answer sheets are mailed to Accord Institute.

2. In the first two weeks, A+ Coaches gather information about the level of the students by observing their performance in the classes and talking to their teachers and parents. After this period, A+ School Team selects the team.
3. After the selection, A+ School Coordinator contacts the parents of the selected students and invites them to the A+ Parent Presentation (downloaded from CMS) scheduled for the second weekend or the third week of school year.
4. After the presentation, parents make a contract with A+ school team. This contract indicates the responsibilities and commitment of the parent, the student, the school and Accord Institute. Those who agree to participate in the program signs and returns the 'A+ Terms and Conditions' document (downloaded from CMS) to the A+ School Coordinator.
5. After the selection is over, the students are enrolled in A+ program by submitting their information to CMS.
6. Finally, the A+ Math and CS Coaches start the weekly classes.

CURRICULUM

A+ math curricula are prepared after careful investigation of the contests that A+ is training its students for. In middle school, the curriculum is based on MathCounts exams and problems. Past MathCounts problems were carefully analyzed and a curriculum was formed based on the topic-distribution of these problems. In the curriculum, for every week there is a topic of the week with an

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explanation of what is being covered that week and a few sample problems.

A+ middle school math program follows a two year based curriculum: Year of the Chicken and Year of the Egg. The two curricula alternate as the years do. A school-year starting at an even (odd) year like 2008-2009 (2009-2010) is a year of the chicken (egg). None is a prerequisite of the other so a student joining the program any year can start with whichever year is being implemented without the knowledge of the other year, which explains the choice of the names chicken and egg. Both years follow a 30-week curriculum first 10 of which are devoted to basic algebra knowledge and skills while the remaining 20 weeks focus on algebra and number theory in years of the chicken and geometry and counting in years of the egg. There are five review weeks in the curriculum: weeks 10, 15, 20, 25, and 30. Please see the Appendix for the curriculum of both years.

CLASSES AND HOMEWORK ASSIGNMENTS

In middle school, A+ math program requires at least 3-hours of weekly classes. These classes are mostly devoted to learning and applying problem solving techniques related to the topic of the week in the curriculum. Every week, three problem sets (penguin, rabbit, and squirrel sets) sent by Accord A+ team, each containing 8 problems, will be given to students as homework for the following week. There is also a review test given every week. The coaches have the option to use it as homework set or to apply it in class as exam. Students should be given enough time, at least one week, before the homework sets are due. Each student is expected to try all the problems in all of the homework sets.

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The first class of a week should be spent on lecturing and solving sample problems. Two useful resources for lecturing are shared lecture notes from other A+ math coaches which can be found on the A+ Online System and A+ library books. For a list of A+ library required and suggested books, please see the Appendix. The remaining classes are devoted to going over homework problems and additional MathCounts, AMC-8 material such as warm-up work-outs and club materials.

Homework sets may be graded at the beginning of a class by writing down the answers on the board and ask the students to switch their sets and do peer-grading. The grading is based on effort and accuracy. The effort-grading is to measure if the students are working on the problems. Students indicate which problems they made an effort on. Making an effort on a problem means working on it for at least 5 minutes or until the student thinks that the problem is solved regardless of the answer being correct or not. The accuracy-grading is the standard grading which considers if the answer is correct or not. The total grades on each set should be marked on the grading box on the top of the page.

Before the review weeks, the students will be encouraged to go over past weeks topics and problems and will be given a review package as homework. A review week exam will be given during the review week. A+ School Math Coaches are responsible to enter both effort and accuracy grades, out of 32 problems, in the A+ Online System every week. Until the past grades are updated, further problem sets will not be accessible.

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CAMPS

Students also participate in monthly A+ activities such as school, regional, and national camps.

A+ Program asks schools to organize 4 school camps in a year to which all the A+ students in the school are invited. School camps could be organized as sleepover or as full day camps. In each school camp, students take a past MathCounts exam with individual, team, and countdown rounds, and go over the solutions of the individual rounds with their teacher.

Schools in the same region are encouraged to organize one regional camp every semester. These regional camps are invitational only and A+ School Coaches and Coordinator in coordination with the A+ Regional Coordinator make the selection based on performance and attitude of the students. They are weekend camps usually from Friday evening to Sunday noon. Students are given a MathCounts exam with all the rounds in it. A+ Math Teacher goes over the solutions of the individual rounds with the students. Also there are math problem solving sessions scheduled in the regional camps. The necessary documents and problems will be provided by Accord Institute.

Accord Institute organizes national winter and summer camps every year. The space is very limited in these camps. Accord Institute A+ Team makes the selection of invited students after consulting with school coaches and sends invitation letters to the parents. The national camps are 5 to 7 days. At the first class of these camps, the students take an exam and according to the results, they are separated into several groups with different levels. There are math problem solving

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sessions in the mornings taught by lecturers from Accord staff and A+ school coaches. Problems for different groups are provided by Accord Institute to the lecturers in advance. Every national camp focuses on one of the four subjects: algebra, numbers, geometry, and counting which are cycled through every two years. On the last day of the camp, students take a MathCounts exam containing all the rounds. In the end of the camp, students will be awarded in several categories like academic performance, most responsible, most helpful, and tidiest.

ASSESSMENT

To determine how the students are improving and how well the program is running, A+ uses the results of exams such as Review Exams, MathCounts, and AMC-8 practice exams.

In addition, A+ students are encouraged to participate in several math competitions throughout the year including MathCounts, AMC-8, Math League, and MOEMS. You may find more information about these competitions and how to register for them in the Appendix.

CHAPTER 4: PROGRAM REQUIREMENTS

Qualified Teachers: Teachers are required to complete A+ training and be certified by Accord Institute to teach an A+ class. There are two training programs organized by Accord Institute every year.

A+ Library: A+ has a library of required and suggested books. These are carefully selected by the A+ team and are required to implement the program effectively. For the list of A+ math library books, please see the Appendix.

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A+ Class: A+ requires weekly classes of at least 3-hours of math and 2-hours of computer science. The students should be given credit by the school for taking these classes.

A+ Camps: A+ requires each school to organize four school camps throughout the year. Schools are also encouraged to organize or participate in two regional camps.

CHAPTER 5: APPENDIX

RESOURCE LIBRARY

All documents, weekly packages and resources can be downloaded from A+ CMS website.

MIDDLE SCHOOL MATH COMPETITIONS OVERVIEW

MATHCOUNTS

http://mathcounts.org

The MATHCOUNTS Foundation is a nonprofit organization incorporated in 1984 to promote math excellence among U.S. middle school students. Since the program began in 1983, over 6 million students have participated. More than 6,000 schools participate in competitions annually from all 50 states. Each year, over 250,000 students utilize MATHCOUNTS materials. Corporations and individuals donate $1.5 million to $1.7 million annually to the national program and over $500,000 to the local and state programs. President George W. Bush

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and former Presidents Clinton, Bush and Reagan have all recognized MATHCOUNTS in White House ceremonies.

CONTEST FORMAT

http://mathcounts.org/Page.aspx?pid=288

Consisting of fun and creative problems, the MATHCOUNTS competitions have written and oral rounds, as well as individual and team components. Though challenging and non-routine, the competition problems focus on the 6th through 8th grade standards of the National Council of Teachers in Mathematics.

Participants advance through School (January), Chapter (February) and State Competitions (March) until the final 228 students are selected from fifty-seven states and territories to advance to the Raytheon MATHCOUNTS National Competition held each May. Results at the state level determine the top four individuals and top coach who earn the honor of representing their state team at the national finals.

Competition Name	MathCounts
Contest Website	http://mathcounts.org/
Grades	6-8
Registration Deadline	http://mathcounts.org/Page.aspx?pid=312 (December)
Registration Fee	$160 ($80 for Title-I schools)
Registration Form	http://mathcounts.org/Document.Doc?id=229
Contest Dates	http://mathcounts.org/Page.aspx?pid=294 (Jan, Feb, Mar, May)
Sample Problems	http://mathcounts.org/Page.aspx?pid=295
Resources	http://mathcounts.org/Page.aspx?pid=315
Awards	http://mathcounts.org/Page.aspx?pid=208

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MOEMS (MATH OLYMPIAD FOR ELEMENTARY AND MIDDLE SCHOOLS)

http://www.moems.org/program.htm

Created in 1977 by Dr. George Lenchner, an internationally known math educator, the Math Olympiads went public in 1979. Last year 150,000 students from 5,000 teams worldwide participated in the Olympiads. All 50 states and 25 other countries were represented. The competition goals are to stimulate enthusiasm and a love for Mathematics, to introduce important Mathematical concepts, to teach major strategies for problem solving, to develop Mathematical flexibility in solving problems, to strengthen Mathematical intuition, to foster Mathematical creativity and ingenuity, and to provide for the satisfaction, joy, and thrill of meeting challenges.

CONTEST FORMAT

http://www.moems.org/contests.htm

There are five monthly contests, given from November to March. No traveling is required. Your school's math club meets weekly for an hour. Club members practice for the contests using non-routine problems from both Math Olympiad Contest Problems Volume 2 or Mathematical Olympiads Contest Problems for Elementary and Middle Schools (or other sources). There are two Divisions: Division E for teams in grades 4-6 and division M for grades 7-8. Each team has up to 35 students. Students take 5 monthly contests at their schools given from November to March. Each exam has 5 non-routine problems. Calculators are not permitted in the exams. The individual scores are the sum of the 5 contest scores of the individual and the team score is the sum of the

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ten highest individual scores, taken after the fifth contest. In the end, certificates for all students and awards for about 50% of all participating students and about 25% of all teams will be shipped to schools. The high scorer of each team receives a trophy. Each student who achieves a perfect score of 25 points receives a bronze medallion.

Competition Name	MOEMS
Contest Website	http://www.moems.org/
Grades	4-6 in Division E, 7-8 in Division M
Registration Deadline	http://www.moems.org/enroll.htm (September)
Registration Fee	Mail Rate: $99, Online Rate: $89.
Registration Form	http://www.moems.org/enroll.htm
Contest Dates	http://www.moems.org/contests.htm (Nov, Dec, Jan, Feb, Mar)
Sample Problems	http://www.moems.org/sample.htm
Resources	http://www.moems.org/Books.htm
Awards	http://www.moems.org/awards.htm

AMC-8 (AMERICAN MATHEMATICS CONTEST-8)

http://www.unl.edu/amc/e-exams/e4-amc08/amc8.shtml

The American Mathematics Contest 8 (AMC 8) (formerly the American Junior High School Mathematics Examination) for students in grades 8 and below, begun in 1985. Around 150,000 students participated in AMC 8 in 2007. It is a contest designed to promote the development and enhancement of problem solving skills in junior high school (middle school) mathematics. Many problems are designed to challenge students and to offer problem solving experiences beyond those

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provided in most junior high school mathematics classes. Additional purposes of the AMC 8 are to promote excitement, enthusiasm and positive attitudes towards mathematics and to stimulate interest in continuing the study of mathematics beyond the minimum required for high school graduation.

CONTEST FORMAT

http://www.moems.org/contests.htm

The AMC-8 is offered at participating schools the Tuesday before the week of Thanksgiving, in late November. It is a 25 question, 40 minute multiple choice examination for students in grade 8 or below. One point is given for each correct answer and no penalty for incorrect answers. Starting in 2008, calculators are not allowed. Subject matter normally associated with the seventh and eighth grade mathematics curriculum including (but not limited to) such topics as the arithmetic of integers, fractions and decimals, percent and proportion, number theory, informal geometry, perimeter, area, volume, probability and statistics, and logical reasoning. Several types of awards are given to all the high scoring students. Specific awards are given to perfect scorers, highest scoring students at each school, the top three students for each school section and high scoring students in 6th grade or below.

Name of the Competition	AMC-8
Contest Website	http://www.unl.edu/amc/e-exams/e4-amc08/amc8.shtml
Grades	8 or below
Registration Deadline	http://www.unl.edu/amc/whatswhen.shtml (October)

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Registration Fee	$33 + $11 for every 10 students
Registration Form	http://www.unl.edu/amc/e-exams/e4-amc08/archive8.shtml
Contest Dates	http://www.unl.edu/amc/whatswhen.shtml (mid November)
Sample Problems	http://www.unl.edu/amc/e-exams/e4-amc08/archive8.shtml
Resources	http://www.unl.edu/amc/d-publication/publication.shtml
Awards	http://www.unl.edu/amc/e-exams/e4-amc08/amc8.shtml

MATH LEAGUE

http://www.themathleague.com/

Formed in 1977 by Steven R. Conrad and Daniel Flegler, The Math League is dedicated to bringing challenging mathematics materials to students. The Math League has Math Contests for Grades 4 through 8, Algebra 1 students, and High School Students. The goal is to encourage student interest and confidence in mathematics through solving worthwhile problems. Schools compete in statewide or multistate league competitions. Over 1 million students participate in Math League contests each year. Contest questions are designed to cover a range of mathematical knowledge for each grade level. Questions on the contests never require any mathematics beyond the grade level tested.

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CONTEST FORMAT (FOR 6TH, 7TH AND 8TH GRADE CONTESTS)

Each contest consists of 40 multiple-choice questions that you can do in 30 minutes. On each 3-page contest, the questions on the 1st page are generally straightforward, those on the 2nd page are moderate in difficulty, and those on the 3rd page are more difficult. There is a 6th Grade Score Report, and a 7th and 8th Grade Score Report sent to schools in each league after the contest.

Students in each league compete for the highest scores, while schools compete for the highest team score: the total of the top 5 scores in each school. Questions may cover: basic topics, plus exponents, fractions, reciprocals, decimals, rates, ratios, percents, angle measurement, perimeter, area, circumference, basic roots, patterns, sequences, integers, triangles and right triangles, and other topics, depending on the grade level.

Competition Name	Math League
Contest Website	http://www.themathleague.com/
Grades	4-5, 6-8, Algebra-1, High School
Registration Deadline	http://www.themathleague.com/index.php?option=com_content&view=article&id=90&Itemid=83 (Grades 6-8: January)
Registration Fee	Grades 4-8: $30, High School: $75 (per set of 30)
Registration Form	http://www.themathleague.com/index.php?option=com_content&view=article&id=106&Itemid=80
Contest Dates	http://www.themathleague.com/index.php?option=com_content&view=article&id=90&Itemid=83 (Grades 6-8: February)
Sample Problems	http://www.themathleague.com/index.php?option=com_content&view=article&id=97&Itemid=79

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Resources	http://www.themathleague.com/index.php?option=com_content&view=article&id=96&Itemid=71
Results	http://www.mathleague.com/reports/leagues.htm

A+ LIBRARY

Estimated Cost of Required Material:	**$599**
Estimated Cost of Recommended Material (optional):	**$205**
Total Estimated Cost (excluding taxes and shipping costs)	**$804**

MathCounts Materials

https://mathcounts.org

> MathCounts Store > Online Store > Coaching Materials

Name	Unit Price	# of items	Total Price
All-time Greatest MathCounts Problems	$17	1	$17
Competition Sets (most recent 5 years)	$25	5	$125
Electronic Countdown Rounds (most recent 5 years)	$12	5	$60
Practice Competitions for MathCounts	$35	1	$35
Stretches, Warm-ups and Workouts	$11	5	$55
			$292

American Mathematics Competitions

http://www.unl.edu/amc/

> Publications > Order form

Name	Unit Price	# of Items	Total Price
DVD - Hard Problems	$25	1	$25
Individual Practice Set for AJHSME/AMC 8 (most recent 5 years)	$2	5	$10
CD - AJHSME/AMC 8 1985-2007, contests, solutions + worksheets	$20	1	$20
AMC-8 Math Club Package with CD	$25	1	$25
			$80

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Canadian Math Competitions

https://cemc.math.uwaterloo.ca

> Order Books > Browse Catalog and Place Order

Name	Unit Price	# of Items	Total Price
Problems problems problems (Volumes 1,2,4,6,7,9)	$15	6	$90
			$90

Art of Problem Solving (optional)

http://www.artofproblemsolving.com/

> Bookstore

Name	Unit Price	# of Items	Total Price
Introduction to Algebra: Textbook & Solutions Manual	$59	1	$59
Introduction to Counting & Probability: Textbook & Solutions Manual	$42	1	$42
Introduction to Geometry: Textbook & Solutions Manual	$57	1	$57
Introduction to Number Theory: Textbook & Solutions Manual	$47	1	$47
			$205

Games

Amazon, Barnes & Noble, Target, Toys-R Us, Walmart

Name	Unit Price	# of Items	Total Price
Blokus	$30	1	$30
Mastermind	$15	2	$30
Connect 4	$13	2	$26
Mancala	$5	2	$10
Set	$12	1	$12
Monopoly	$13	1	$13
Chess	$8	2	$16
			$137

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COMPUTER SCIENCE COACH HANDBOOK

A+ COMPUTER SCIENCE PROGRAM

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CHAPTER 1: OVERVIEW

WHAT IS A+ COMPUTER SCIENCE PROGRAM?

A+ Computer Science (CS) Program is for advanced students in middle and high schools that aim to motivate them by challenging problems in CS topics while training them for prestigious national and international math competitions, like USA Computing Olympiads (USACO), and International Olympiads in Informatics (IOI).

GOALS, BENEFITS, AND DISTINCTIVE FEATURES

The goal of A+ CS Program is to:

> *"inspire and motivate students and increase their interest and confidence in CS by training them for prestigious CS competitions".*

The benefits include learning problem solving skills, a huge plus in college applications, college-life and throughout their careers:

- The students will learn the mysteries and joys of problem solving and these skills to solve CS problems which they can apply to other parts of their life. Most of the science, industry, finance jobs are based on problem solving and one who can solve CS problems has the potential to solve any kind of real life problems because math and its logic is in the core of all the subjects and sciences.

The distinctive features of the A+ CS Program are A+ camps, learning analytical reasoning, and improving social, team skills:

- A+ camps have problem solving classes, fun competitions, and team activities. They improve student motivation throughout the

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year. Students love the camps and they work hard to be selected for the following A+ regional and national camps.

The A+ CS Program is based on understanding the basic programming concepts, logic and reasoning instead of focusing on applying formulas. Instead of memorizing the lecture notes, A+ CS Program focuses on the analytical reasoning behind the formulas, hence applies inquiry based learning techniques in its lecture notes always asking questions to the students instead of providing programming code or formula.

A third distinctive feature of the A+ CS Program is that it does not see students as problem solving machines and focuses on increasing their social, team skills which will help them throughout their life. In today's world, one cannot be successful without these important skills. A+ camps offer many team and social activities like sport activities, team games and competitions, and great social games like traditional A+ camp game: 'Detective, Thieves, and Robin Hood' (DTR). You may find more information about DTR in Appendix.

USACO SYSTEM

USACO online system is composed of a training gate for beginners and contests throughout the year in three different levels (bronze, silver, and gold) in terms of problem difficulty. Beginners enter the training gate to improve their level by reading the lecture materials and solving the questions. All students can enter bronze contests but silver and gold levels are by invitation only depending on the student performance in former contests. At the end of the school year, around top-15 students based on their performances in the contests are invited to the one-week USACO National Camp where the National Computer

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Team composed of 4 students is selected. USA National Computer Team represents US in International Olympiads in Informatics (IOI) which has participants more than 85 countries.

USACO bronze level requires introductory level programming, and algorithmic problem solving skills. Silver level student needs strong background in programming and algorithms whereas gold level student needs to be proficient in programming and problem solving especially Dynamic Programming in addition to the former ones. See http://www.usaco.org/ for further information on USACO.

A+ STRUCTURE

In member schools, A+ CS Programs are run by A+ School CS Coaches in coordination with the A+ School Coordinator and A+ CS Coordinator at Accord Institute.

A+ has two major components: weekly classes and camps.

A+ CS middle school component is a three-year program with two levels and aims to teach CS topics and problem solving techniques used in national middle school level competitions like USACO:

- **Level 1**: Beginners in programming (6th & 7th grades)
- **Level 2**: Beginners in algorithms (8th grade)

In addition to the CS lectures in school, A+ curriculum has different strategy in camps. CS lectures are only for level 1 students in camps. Camp lectures focus on improving critical thinking and reasoning, and problem solving skills. Hence, CS lectures are based on introductory level game theory, in other words, math game strategy analysis. Later in the high school, the lectures will help in understanding CS problems

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in Artificial Intelligence, and will let them write their own programs implementing advanced game strategies and playing games.

CHAPTER 2: METHODOLOGY

STUDENT MOTIVATION

A+ Camps: A major component of A+ CS Program is A+ camps that aim to increase student motivation. In addition to fun lectures, the camps contain several fun activities, team games and competitions to show the students the cool side of CS.

Non-routine problems: The problems used in weekly classes are designed to encourage thinking and challenge the students instead of practicing routine methods and calculations.

Make it fun: A+ classes and activities should be remembered by students as fun activities. Give points to students for solving problems. Make problems interesting by including stories in the problems about your students and their hobbies. For variables, use fun notation like apples and pears instead of the traditional boring *x, y* notation. Organize occasional individual or team competitions. Most students love to compete. It is also a good idea to have food for weekly gatherings.

Promote effort: Promote working hard and effort rather than being smart. Working hard and understanding only parts of it is better than being smart and doing nothing. As the saying goes, a walking turtle covers more distance than a standing rabbit.

Be encouraging, set individual goals: Do not discourage students by their low scores on exams! The exams they will take are not easy ones

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and they have three years of preparation to reach their maximum potential. If they got 1 correct answer in 5 problems, ask them to work hard and try increasing that score to a 2 or 3 next time.

TEACHING HOW TO LEARN

Avoid using formulas: Instead, teach them the underlying analytical reasoning and problem solving techniques. Instead of directly providing the proof, use inquiry based learning method (e.g. asking each step of the proof) to make them do the proof.

IMPROVING SOCIAL, TEAM SKILLS

A+ School team t-shirts: This would increase the team spirit among the students.

Team competitions: Include team games and activities in A+ camps. They will learn useful skills on splitting the task and working efficiently as a team, helping others, and asking help from others.

Social games: Have them play games which force them to talk to each other. Detective, thieves, and Robin Hood is a great example. It is a role playing game where they play a character and they have to talk and convince others to stay in the game. More information about the rules can be found in the Appendix.

Sports: Have outdoor activities in A+ camps. Team games like soccer, dodgeball, capture the flag are great examples.

PARENT INVOLVEMENT

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Parent Presentation: Make a parent presentation for selected students to inform the parents about the program and to invite them to participate.

Home visits: Plan home visits to meet with the parents earlier in the year.

E-mail group: Make an e-mail group to share news.

Call them: Make occasional phone calls to talk about how the student is doing. Remind them about upcoming A+ camps and ACCompete. Share good news about success of the student and the program with them.

Show your dedication: Let them see that you are putting a lot of effort for their kids.

Ask for support: Do not be shy. Ask for support whenever needed. You are working for the future of their kids and they will love to help you! There are several ways for parent support: They could take turns to bring food to weekly gatherings or school camps. They could help you with transportation for the A+ camps. They could make donations or ask their companies to make donations.

PUBLICITY

School Walls: Advertise the program in the school by hanging news and pictures from the A+ camps.

Annual Presentations: Make annual presentations to school, parents, and local sponsors about the program in school and successes that year.

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School Newsletter: Write or ask students, parents to write articles in the school newsletter about A+ program, events, and competitions.

A+ bake sale: Organize an A+ bake sale. Ask A+ parents to bake and bring cookies etc. to sell to all the students in the school. You may use the sales money for A+ students, to buy them books or organize A+ camps.

CHAPTER 3: IMPLEMENTATION

SUMMARY

A+ implementation consists of two main components: weekly classes and camps. At the beginning of every year incoming students take a placement exam to participate in A+. After the selection, the classes begin.

A+ CS program requires at least 2 hours of weekly classes which follows a three-year A+ CS curriculum each year consisting of 30 weeks. Classes are devoted to teaching the students problem solving techniques and equipping them with tools to solve challenging CS problems. Weekly homework assignments and quizzes are given to students and the homework grades based on effort and accuracy are recorded on the A+ Online Course Management System (CMS)[1] by the school CS coach.

A+ has 4 school camps, 2 regional and 2 national camps throughout the year. The school camps are organized by school as either sleepovers or full day camps, the regional camps are organized by several

[1] A+ CMS website: http://accordeducation.org/A+/cms/.

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participating schools in a region as a weekend camp, and national camps are one-week long organized by Accord Institute.

As assessment, Accord Institute uses competitions and practice competitions such as ACCompete, Scratch Project Competition and USACO training gate. Students also take evaluation exam at the beginning and in the end of the year to measure the growth-level.

A+ ONLINE COURSE MANAGEMENT SYSTEM

A+ CMS has the following features to help organizing A+ CS class at the school:

- Following up A+ reminders and events
- Student reporting, monitoring student progress, student status among all A+ students
- Easy follow-up of A+ tasks via A+ school checklist
- Course material available for download
- Online grading and attendance

For details, refer to the CMS session at Accord Institute A+' training.

STUDENT SELECTION PROCESS

A+ is an advanced program which requires certain level of CS skills and talent. So, only selected students may participate in the program. The goal is to have 10% to 20% of the incoming students participating in A+.

A+ School Coordinators are primarily responsible for the A+ student selection process in their schools. The selection is done in the first three weeks of the school year. The steps of A+ student selection process is as follows:

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1. In the first week, A+ Placement Test downloaded from A+ CMS is given to all the incoming students and any other student who wants to join the program. A+ Coaches grade the placements test using automated grader downloaded from CMS. The placement test booklets are **destroyed** and all the student answer sheets are mailed to Accord Institute.
2. In the first two weeks, A+ Coaches gather information about the level of the students by observing their performance in the classes and talking to their teachers and parents. After this period, A+ School Team selects the team.
3. After the selection, A+ School Coordinator contacts the parents of the selected students and invites them to the A+ Parent Presentation (downloaded from CMS) scheduled for the second weekend or the third week of school year.
4. After the presentation, parents make a contract with A+ school team. This contract indicates the responsibilities and commitment of the parent, the student, the school and Accord Institute. Those who agree to participate in the program signs and returns the 'A+ Terms and Conditions' document (downloaded from CMS) to the A+ School Coordinator.
5. After the selection is over, the students are enrolled in A+ program by submitting their information to CMS.
6. Finally, the A+ Math and CS Coaches start the weekly classes.

CURRICULUM

A+ CS curricula are prepared after careful investigation of the USACO contests and learning abilities of middle school students in programming. In the 6th grade, students start learning programming

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with Scratch programming language developed by MIT Research Lab for youngsters. It's been shown that Scratch simplifies to learn basic programming concepts such as variables, input/output, conditions, and loops, and makes programming fun for kids. In the next step, conceptual understanding of programming provided by Scratch helps to switch a more advanced programming language, C++ which is the most efficient language accepted by USACO. In short, Scratch programming language is used to teach programming in C++ in the entire 6th grade. In the 7th grade, students improve their programming skills in scratch and C++ with projects in addition to the lectures in introductory level discrete mathematics (Graph Theory, Combinatorics, and Number Systems). 8th grade curriculum consists of lecture notes designed for self study to learn introductory level algorithms necessary and supplementary for USACO training gate. All level 2 students are obliged to register USACO training gate at http://ace.delos.com/usacogate. High school curriculum is also self study based in USACO system and consists of algorithms for USACO levels. Student level is not determined by his/her class but his/her level in USACO competition.

SYLLABUS

Syllabuses can be dwonloaded from CMS:

- **Level 1 – Part 1** (6th grade): Curriculum under CS Level 1.1 Course
- **Level 1 – Part 2** (7th grade): Curriculum under CS Level 1.2 Course
- **Level 2** (8th grade): Curriculum under CS Level 2 Course

LESSON PLANS

A+ CS lesson plans are based on 30 weeks in a school year in the school. Each week, 2 hours are required. Lesson plans in level 1 have weekly

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written assignments, quizzes, and programming assignments. They can be downloaded from CMS:

- **Level 1 – Part 1**: Annual plan under CS Level 1.1 Course
- **Level 1 – Part 2**: Annual plan under CS Level 1.2 Course
- **Level 2**: Annual plan under CS Level 2 Course

Assuming each class is 45 minutes, teachers are recommended to have:

- 5 minutes for solving last homework, brief review of the last class
- 30 minutes for lecture
- 5 minutes for quiz
- 5 minutes for motivation, team work and review.

LECTURE NOTES

Lecture notes are prepared for middle school only; books will be used in the high school. See Resource Library section for details. All lecture notes are based on inquiry based learning; they don't provide the proof or answer directly but make students find the answers by asking questions. Answering each question, student gets closer to the answer. Level 1 lecture notes are designed for teachers and students separately, and they include lecture slides. Teacher's lecture notes provide guideline to the teacher in the class including the approximate time required for the topic, analogies for concepts, in-class activity hints, and solutions to the exercises. All the programming codes are tasted and also provided as separate files in the lecture note package. They can be downloaded from CMS.

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CLASSES AND HOMEWORK ASSIGNMENTS

Every week, one problem set (avaialble on CMS) each containing 3 to 8 problems, and programming problems (including optional ones) will be given to students as homework for the following week. Homework sets are graded based on effort and accuracy. The effort-grading is to measure if the students are working on the problems. Students indicate which problems they made an effort on. Making an effort on a problem means working on it for at least 5 minutes or until the student thinks that the problem is solved regardless of the answer being correct or not. The accuracy-grading is the standard grading which considers if the answer is correct or not. Each week, students will be given the quiz of the week provided in A+ CS package. All grades must be weekly updated on CMS by the A+ CS Coach.

CAMPS

Students also participate in monthly A+ activities such as school, regional, and national camps. For sample sleepover, regional and national camp schedules, please see the Appendix.

A+ Program asks schools to organize 4 school camps in a year to which all the A+ students in the school are invited. School camps could be organized as sleepover or as full day camps.

Schools in the same region are encouraged to organize one regional camp every semester. These regional camps are invitational only and A+ school coaches and coordinator make the selection based on performance and attitude of students. They are weekend camps usually from Friday evening to Sunday noon.

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Accord Institute organizes national winter and summer camps every year. The space is very limited in these camps. Accord Institute A+ Team makes the selection of invited students after consulting with school coaches and sends invitation letters to the parents. The national camps are 5 to 7 days. At the first class of these camps, the students take an exam and according to the results, they are divided into groups with different levels. Each day, there is a one-hour CS lecture in the afternoon taught by Accord and A+ school coaches. In the end of the camp, students will be awarded in different categories like academic performance, most responsible, most helpful, and tidiest.

School and regional camps have 1 hour of CS lectures whereas winter and summer camps have 3 and 5 hours for level 1 students. Camp CS lectures for level 1 (two-year package) alternates each year. In both school and regional camps, students learn to do analysis on strategy games in CS lessons. Necessary documents and problems will be provided by Accord Institute.

ASSESSMENT

To determine how the students are improving and how well the program is running, A+ uses the results of exams such as Accompete, quizzes and homework assignments.

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CHAPTER 4: PROGRAM REQUIREMENTS

Qualified Teachers: Teachers are required to complete A+ training and be certified by Accord Institute to teach an A+ class. There are two training programs organized by Accord Institute every year.

A+ Library: A+ has a library of required and suggested resources. These are carefully selected by the A+ team and are required to implement the program effectively. For the list of A+ CS library resources, please see the Appendix.

A+ Class: A+ requires weekly classes of at least 3-hours of math and 2-hours of computer science. The students should be given credit by the school for taking these classes.

A+ Camps: A+ requires each school to organize four school camps throughout the year. Schools are also encouraged to organize or participate in regional camps.

CHAPTER 5: APPENDIX

RESOURCE LIBRARY

Programming languages Scratch and C++ can be downloaded freely from:

- http://info.scratch.mit.edu/Scratch_1.4_Download
- http://www.codeblocks.org/downloads/26

In the middle school, along with the lecture notes assignments and quizzes are provided by Accord Institute for level 1. Level 1 consists of

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weekly written assignments, quizzes, and programming assignments. Solutions are also provided including the source codes. Written assignments consist of 2 to 6 from the lecture of the week. Each week there is an additional question which is a type of brain teasers, puzzles, or tricky questions in order to stimulate student thinking. Similarly, quizzes consist of 2 to 4 questions related to the last lecture. Continuous practice is required to learn programming hence students are given up to 4 weekly programming assignments. The first one is required, and the remaining ones are given as long as student progresses. The weekly packages, lecture notes and materials can be downloaded from CMS.

Additional resource on Scratch:

- Scratch Programming for Teens, J. L. Ford, Course Technology PTR, 2008.
- Scratch challenging projects: http://www.uwp.edu/sws/usaco/Scratch/index.htm
- Scratch programming projects: http://nebomusic.net/scratch.html
- Scratch resources for teachers: http://wiki.classroom20.com/Scratch

In level 2, the main resource is USACO training gate http://ace.delos.com/usacogate.

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COMPETITIONS OVERVIEW

US COMPUTING OLYMPIAD

There are not many computer science competitions in US. USACO is the most significant one but its level is for high school level although middle school participants are accepted. Homepage is http://www.usaco.org. Participation is free. You can find all necessary links about contests, registration, and schedule. USACO is briefly explained above in USACO System section. USACO has seven monthly contests from October to April in each three different levels (bronze, silver, gold). October contest is optional and for determining the level of the student. April contest is the most important one in terms of contest score weighting, and the remaining one have equal weight.

Registering for USACO online training gate is strongly recommended for the students that will participate in USACO. Training gate is located at http://train.usaco.org. New users can also register there. The contests are available for 3 or 4 days at the given dates in the website. One can only participate in that interval. Once the participant started the contest, he/she will have 3 or 4 question to solve in 3 to 5 hours – it will be provided before the competitions.

ACCOMPETE

Accord Institute implemented its own CS competitions; ACCompete[2] and Scratch project competition[3]. ACCompete is Accord Institute's computer science competition for middle schools. It is an online

[2] ACCompete website: http://accompete.accordeducation.org
[3] TIE & Scratch Contest website: http://tiescratch.accordeducation.org/

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competition open to currently middle school student of Accord member schools. But it will be for any middle school students in the upcoming years. It has 4 contests throughout the year; starts in December, and has typically following contests in February, March and April. The contents of the contests are in Scratch and C++ programming, and aligned with A+ CS curriculum. Top-3 student according the cumulative score of the 4 contests and their teachers will be awarded.

SCRATCH PROJECT COMPETITION

Scratch programming language is very appropriate for developing creative projects, and it has no limits. Scratch project competition is for middle school students of Accord affiliated schools. It is similar to TIE contest; the only difference is that students will use scratch programming language for their project. In the competition, there will be stories determined by the organizers, and students will try to implement the story visually in Scratch. Top-3 students chosen by the referees and their teachers will be awarded. Registration is online.

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