THEMATIC ENHANCEMENTS FOR THE SUMMER TRANSPORTATION INSTITUTE

FINAL REPORT SUBMITTED TO THE OHIO TRANSPORTATION CONSORTIUM

BY

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Acknowledgements

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INTRODUCTION

Central State University has been conducting a Summer Transportation Institute (STI) since 2000 with the support of the Federal Highway Authority (FHWA) and the Ohio Department of Transportation (ODOT). Typically about twenty high school students from Grades 9-11 are brought for a four week institute where they learn about different modes of transportation, career opportunities and the basics of physics and mathematics. Professionals from external agencies associated with transportation teach the elements of their professional work for the students and encourage them to consider careers in transportation. We also teach them civil rights aspects and renewable energy applications in transport.

For the Year 2008, the STI was held from June 22 – July 16.

PROJECT FOCUS

The Central State University focuses on enhancing the content of the Summer Transportation Institute (STI) by using educational technology tools such as SMART BOARD and by adding a GPS component for the curriculum. The STI was initially attended by 29 students from grades 9-11 interested in careers related to transportation.

ACCOMPLISHMENTS

Equipment Purchase and Use of Equipment:

We purchased 23 Garmin GPS Units, 3 lap top computers and two Smart Boards to be used for the STI. Two of the laptop computers were used in conjunction with the Smart Boards. Smart Boards enabled projection of presentation materials from the computers. One lap top was made available to Dr. Kandiah, the faculty coordinator for the program to enable him to prepare for the instructional materials. This was also loaded with the Smart Board Software. The Garmin GPS units were used in the instruction in the STI program.

Interactive Smart Boards along with the software loaded in the computers allows the use of board screen by the presenters instead of mouse cursor and making notes on the presented material on the board interactively. This enhanced the instructional delivery in the program. The STI involves the students presenting their capstone projects using MS Power Point program. The computers and the Smart Boards were used for practicing their presentations on the last day of the program as well.

Use of Smart Board and Computers for the STI

Enhancement of the Summer Transportation Institute with the Addition of GPS Curriculum

The Annual Summer Transportation Institute funded by the Ohio Department of Transportation was held from Jun 22nd, 2008 – July 16, 2008. With the support from the Ohio Transportation Consortium, we included a curriculum in the use of GPS units. Nearly 30 high school students in grades 9-11 from different parts of the US attended the Summer Transportation Institute. The following aspects of GPS units were taught for the students:

- General Coordinate Systems
- Finding location coordinates of points of interest
- Tracing paths
- Reaching given location using GPS

The curriculum was based on the SATELLITES Workshop held by University of Toledo for Earth Science Teachers.

Introduction to GPS Class Room Instruction

GPS Field Exercise

GPS Treasure Hunt Exercise

Summer Transportation Institute Schedule for July 03, 2008

Schedule Indication GPS Curriculum

DAY	TIMES	ACTIVITIES
07/03/08 Thursday	7 :30am – 8:30 am	Breakfast
	8:30 am – 9:00 am	Open Discussion
	9:00 am – 12:00 pm	Introduction to Global Positioning Systems (GPS) & GPS Lab Activities
	12:00 pm – 1:15 pm	Lunch
	1:30 pm - 4:15 pm	Wright Paterson Air Force Museum
	4:15 pm-4:45 p.m.	Travel Back to Campus
	5 pm – 6 pm	Dinner

DETAILS OF THE GPS CURRICULUM INSTRUCTION FOR STI

Appendix – Report on GPS Training – STI Workshop

The GPS training for the STI students was held on July 3rd, 2008 from 9:00am to 12:00pm. First, the theory behind the GPS was presented with the aid of the hand out (see pages 2 and 3). Workshop participants were divided into twelve groups, and each group consisted of two people. Each group was given a GPS unit of *Garmin GPSMap® 60CSx* model. A class demonstration of the GPS equipment, *Garmin GPSMap® 60CSx,* was done by Dr. Kandiah with the assistance of Dr. Yedes Adou and Mr. Lemi Laki. Two pages of the quick start guide (see pages 4 and 5) of the equipment were handed out to each group for its reference during the field work.

Training was followed by description of the field exercise (page 6). This field exercise, titled "Treasure Hunt" was inspired by the training exercise used in the SATELLITE workshop held at CSU, and described in the latter part of this report. A thirty minute field demonstration of the GPS unit on its main features with dummy targets was conducted by Dr. Kandiah with the assistance of Dr. Adou and Mr. Laki.

"Treasure Hunt" Exercise: Two "treasure troves" ('Ruby trove' and 'Emerald trove') were given to each group; a water cup with golden sand marked with green marker of the group number and 'F(irst)' was used as an 'Emerald trove' and a water cup with red letters of the group number and 'S(econd)' was used as a 'Ruby trove'. Each group was asked to hide its troves in two different locations in the vicinity of the McLin Building, CSU with the coordinates recorded in the GPS. Once the "hiding process" was completed, the GPS equipment was collected from each group, and randomly distributed to another group. Once all the groups received a GPS unit with records, they were sent at the same time to find and bring the hidden treasures. They were also asked to record their tracking during the search using the GPS units. The group that first brought the troves was announced as the winner.

In the exercise, it took approximately seven minutes for the winning group to bring the hidden troves, and twenty minutes for the last group to get them. No group failed in its search and no trove was taken by any pirate before the designated group found its target. In addition to Dr. Kandiah, Dr. Adou and Mr. Laki, student counselors assisted and guided the participants in the exercise (page 7 shows the sample Treasure Hunt worksheet used, page 8 shows the worksheet with the exercise records, and pages 9 and 10 present photos taken during the process). After all of the groups found their target troves, a class discussion was held for students to share their experiences and for the instructor to evaluate the goals of the exercise.

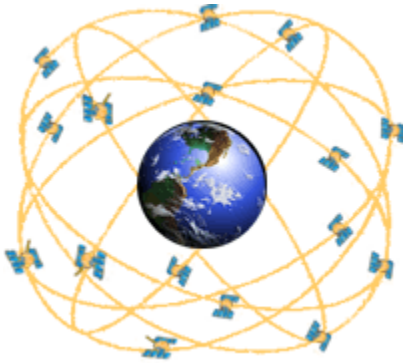
The students were generally happy about the exercise, which taught them the principles of the GPS. (The last group was disappointed when it could not fine one of its target troves at the marked location on the ground; however, they finally found it hanging on the tree. Certainly, those two participants were not happy for some time.) Although some in the class had previous experiences with using GPS in their cars, they seemed to be happy about understanding the principles behind the GPS technology. The competitive nature of the exercise helped keep them working with a keen interest.

I wish to thank Dr. Kevin Czajkowski, University of Toledo, for giving permission for using his SATELLITE workshop training materials for designing our exercise.

Overview of GPS

Give students an overview of GPS technology including, what the GPS constellation is and how GPS units receive signals and determine the user's position.

GPS constellation



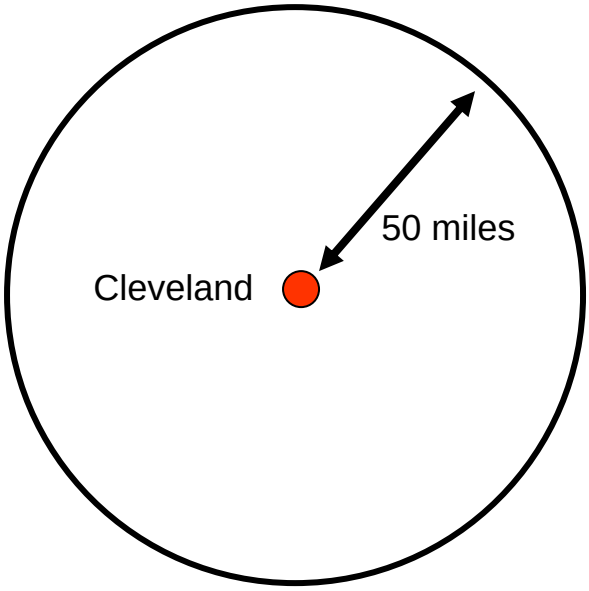
Courtesy of www.nasa.gov

- Department of Defense developed, worldwide, satellite-based radio navigation system
- Consists of 24 operational satellites
- Provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time
- Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock
- Each GPS satellite orbits the Earth twice a day
- Each satellite transmits signals to Earth
- GPS receivers measure the time between when satellites sent a signal relative to the GPS receiver receiving the signal
- Tells how far away the satellite is
- Signals from several satellites will give accurate results

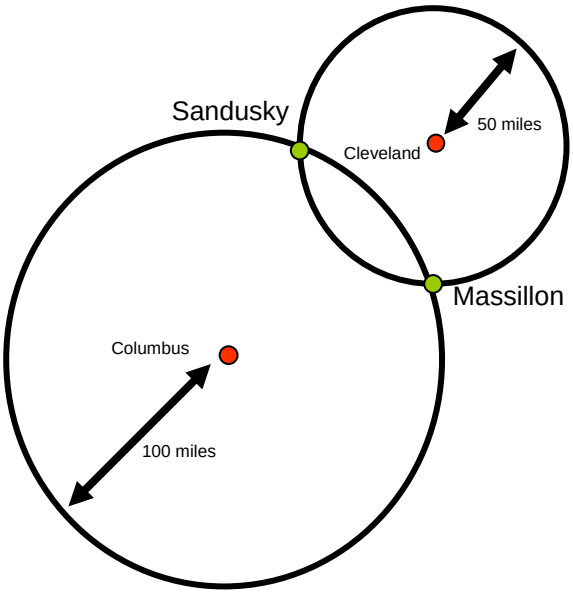
Trilateration

Explain the concepts of trilateration – the means of finding a position using 3 or more points of reference.

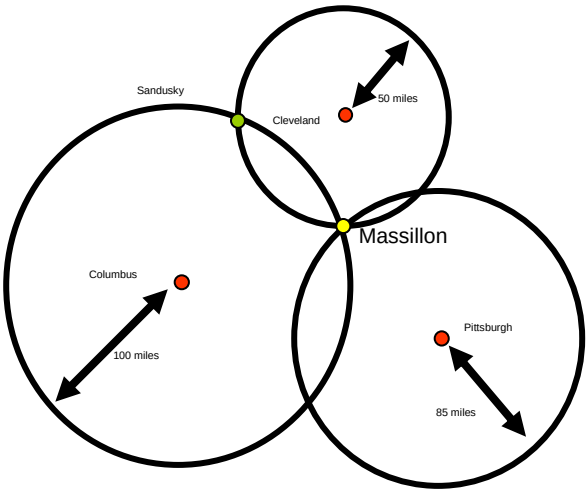
For example, in 2-dimensional space, someone can tell you that you are 50 miles from Cleveland. If that is your only point of reference then if you draw a circle with a radius of 50 miles then you may be anywhere on the circle. This can include, the middle of lake Erie, Canton and Sandusky.



If, however, you are also told that you are 100 miles from Columbus, then if you draw a circle around Columbus that has a radius of 100 miles, that circle will intersect the first circle at 2 points, in this case at Sandusky and Massillon. A third point of reference is needed.



By adding one more point of reference, for example, your location is 85 miles from Pittsburgh, then it is possible to determine where you are, as this last circle will intersect the other 2 circles at one point. The example used places us in Massillon.



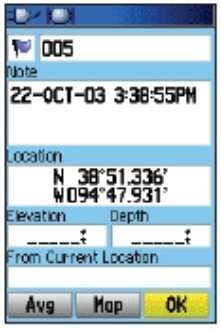
GPS uses the same trilateration principal when detecting signals from a GPS satellite.

Ensure students can read latitude and longitude

Either get students to located places on a topographic map, or use Google Earth to find locations. Note that in Google Earth, under "tools" and then options, you can change the coordinate system to display digital degrees. Also under view you can switch on the latitude and longitude grid. Demonstrate how the numbers increase and decrease as you move north, south, east and west.

Marking Your Location as a Waypoint

A waypoint is a geographic location that you specify, it can be your current location, a point on the Map Page or any item from the Find Feature database. Waypoints are saved to the Find Menu.



1. Press and release the **MARK** key to display the Mark Waypoint Page. Observe that your current position is assigned a map symbol, a unique identification number, a date and time of recording, location coordinates, and if available elevation and depth.
2. To save the waypoint to the Waypoints List, use the **ROCKER** key to select "**OK**" and press **ENTER**.

To personalize the Waypoint, refer to the "Using Waypoints" section of the Owner's Manual.

Using the Map Page

The Map Page displays a detailed map of the area around your current location. You can view your progress when moving or navigating to a chosen destination. The **IN** and **OUT** keys allow you to change the map scale and configurable data fields provide navigation information.

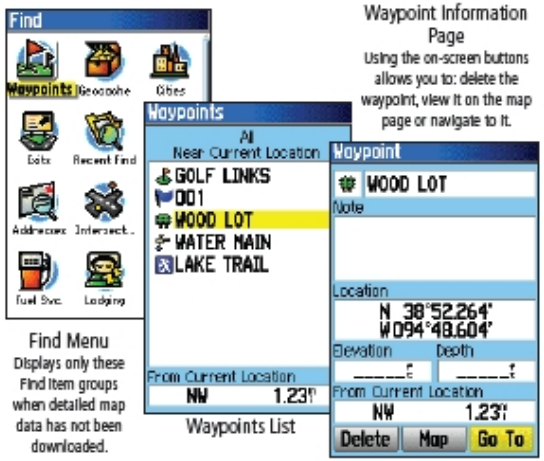
1. Press the **PAGE** key to cycle the Main Pages until the Map Page is displayed.
2. Press the **MENU** key to view options for the Map Page.
3. Begin to move about and observe the Position Arrow on the map. Use the **ROCKER** key to move the Panning Arrow to highlight a map item or view more map area.

Refer to the Owner's Manual for more details.

Finding a Destination (Waypoint)

You can search for a destination using the Find Menu. A destination can be any map item such as a Waypoint, City, or Point of Interest (restaurant, museum, etc.) available from the map database. Without downloaded detailed map data from Garmin MapSource®, only waypoints, cities, interstate exits and geocache points can be used as destinations.

1. Press the **FIND** key to display the Find Menu.
2. Use the **ROCKER** key to select the Waypoints icon and then press **ENTER** to display the list of waypoints. By default, the list shows only those nearest to your current location. Press the **MENU** key to view the options list.
3. Use the **ROCKER** key to scroll through the list until the desired waypoint is highlighted. Then press **ENTER** to display the information page for that waypoint.
4. Use the **ROCKER** key to select the "**Go To**" button at the bottom of the page. Then press **ENTER** to begin navigation to the waypoint.



Waypoint Information Page
Using the on-screen buttons allows you to: delete the waypoint, view it on the map page or navigate to it.

Find Menu
Displays only these Find item groups when detailed map data has not been downloaded.

Waypoints List

Navigating to a Waypoint

When using "Go To" to navigate, you are directed to follow a direct line (or course) to the waypoint. The direction you are to move is the heading (eg. N, S, E, W). If you stray off course you can use a bearing (compass pointer) to be redirected toward your destination. The Map, Compass and Trip Computer Pages use these elements to direct your navigation efforts.

1. Press the **PAGE** key repeatedly until the Compass Page is displayed. This page contains a "Bearing Pointer" and a "Compass Ring".

   The Bearing Pointer indicates the direction to go and the Compass Ring rotates to indicate North orientation when you begin to move. Digital Data fields at the top of the page display selectable navigation information such as speed, distance to go, elapsed time, etc.
2. Press the **QUIT** key to move to the Map Page and observe your progress toward the waypoint. A Bearing line displays on the map and the Position Arrow moves as you move.
3. Press the **QUIT** key again to move to the Trip Computer Page. This page provides travel data such as a trip odometer, maximum speed, etc.
4. To stop navigation, press the **MENU** key with the Compass or Map Page displayed, then select "Stop Navigation" and press **ENTER**.

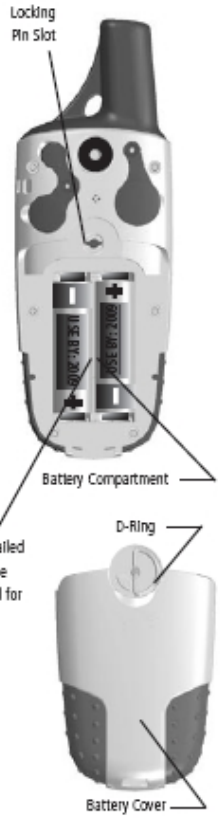
Compass Page | Map Page | Trip Computer

Part Number: 190-00482-01 Rev. A Printed in Taiwan

Battery Installation

The GPSMAP 60CSx operates on two "AA" batteries (not included), which are located in the back of the unit. Alkaline or NiMH batteries may be used (see the Owner's Manual for setting the battery type). Stored data is not lost when the batteries are removed.

1. To remove the battery cover from the back of the unit, turn the D-Ring 1/4 turn counter-clockwise and then pull the cover away.
2. Insert the batteries, observing the proper polarity. A polarity diagram can be found molded into the battery compartment.
3. Reinstall the battery cover by inserting the bottom slot over the tab at the base of the unit and reinserting the locking pin in the back of the unit.
4. Turn the D-Ring 1/4 turn clockwise to lock the cover in place.



The microSD Card used for storing detailed mapping data is located beneath the batteries. Refer to the Owner's Manual for detailed information.

When replacing batteries, use only new or fully charged batteries. Do not mix Alkaline and NiMH batteries. Rechargeable batteries may have less capacity than disposable batteries.

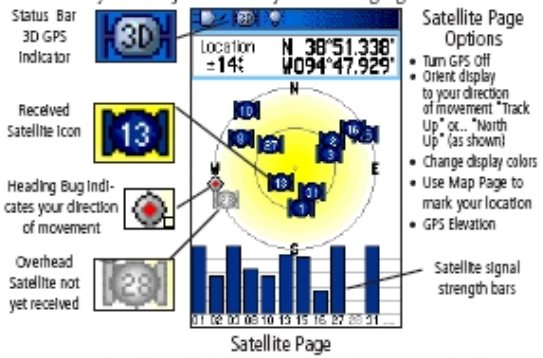
Extensive use of backlighting, WAAS and key beep tones will significantly reduce battery life.

Start-Up and Satellite Acquisition

Find a location where you have a clear view of the sky. If you're starting up for the first time or you have moved over 600 miles since last using the GPSMAP 60CSx, it must initialize (determine its location by searching for satellites that are in position over your current location.) Press the **MENU** key to use the Location option from the Satellite Page Options Menu to mark your approximate location on the Map Page so it looks for only those satellites above your location.

1. Turn On the GPSMAP 60CSx by pressing and releasing the **POWER** key. A Welcome Page will briefly appear before moving to the Satellite Page.
2. Observe the Satellite Page and the GPS status messages as they appear at the top of the page.
   - "Acquiring Satellites" message appears as the GPSmap 60CSx begins to search for satellites overhead.
   - Your "Location Coordinates" display when four or more satellites are fixed (enough to determine an approximate elevation as well as ground location).

If the GPSMAP 60CSx can't get past the "Acquiring Satellites" message or you get a "Lost Satellite Signal" message, move to a new location away from objects that may be blocking signals.



Satellite Page

Displays your location coordinates, position accuracy, a view of the satellites overhead, and bar graph showing the signal strength of each overhead satellite.

Adjusting the Backlighting

When lighting conditions may make it difficult to view the GPSMAP 60CSx display, turn on the backlighting and adjust it to the desired level of brightness.

1. With the GPSMAP 60CSx On, press and release the **POWER** key to display the Backlight Adjustment Slider.
2. Press and release the **POWER** key to increase the brightness level.
3. To close, press the **ENTER** key.


Adjustment Slider

The backlight is factory set to timeout in 15 seconds, unless connected to an external power source. Refer to Display Setup in the Owner's Manual to change the timeout period.

Altimeter and Compass Calibration

To calibrate the Electronic Compass and Altimeter, see the Owner's Manual.

Viewing the Main Pages

The Main Pages provide the information you need for basic navigation using the GPSMAP 60CSx. Press the **PAGE** key repeatedly to cycle from one Main Page to another.


Satellite Page | Trip Computer Page | Map Page | Compass Page | Altimeter Page | Main Menu

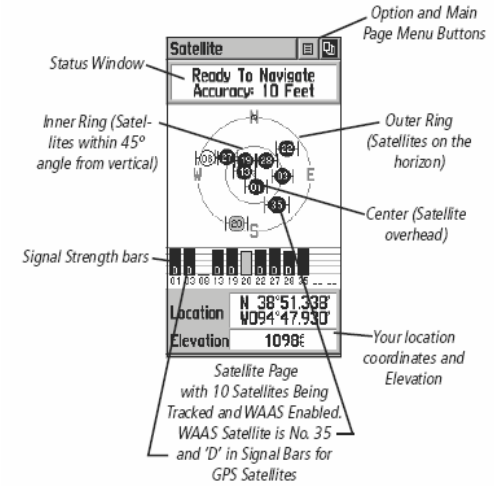
Satellite Page - Provides reference for satellites being tracked.
Trip Computer Page - Provides trip and navigation data.
Map Page - Displays a map and references your movements.
Compass Page - Provides guidance to a destination.
Altimeter Page - Provides tracking of elevation and pressure.
Main Menu - A directory of advanced features and settings.

GPS Exercise

This entire part of the exercise is held outdoors

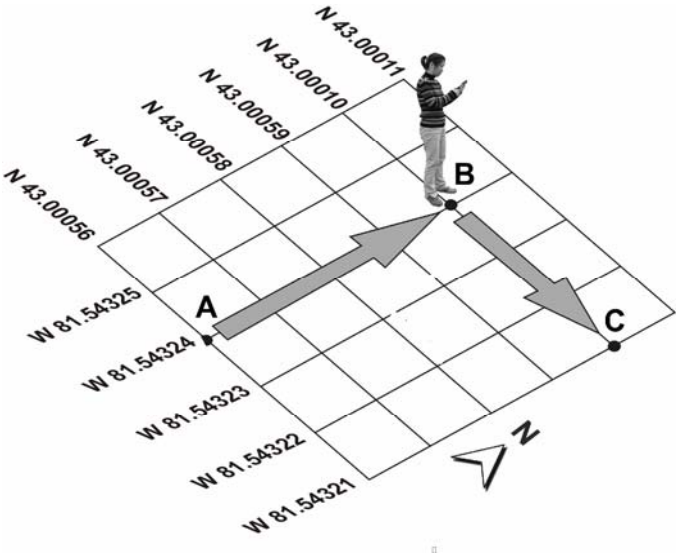
Introductory Exercise

Have all students switch on GPS units and navigate to the “satellites” page. The satellites page shows all the satellites that the GPS unit should be able to detect as well as the coordinates of the location, and the accuracy (in the window below it is 10ft). This will be displayed in meters if the units were set up as instructed.



In order to see that direction you are moving in, simply hold the GPS up and start walking. You will see the coordinates changing with every second or third step. By looking at how the coordinates are changing you can tell what direction you are moving in. For instance, as the latitude increases, you can tell you are moving northward. As it decreases, you are moving southward. Since we are west of Greenwich, as the longitude increases you are moving westward; as it decreases you are moving eastward.

This simple exercise quickly gives students a sense of direction relative to the coordinates



Hand out treasure hunt worksheet and commence the hunt

Once students are divided into groups, hand each group a worksheet with the coordinates and accuracy readings. Let them know what they are trying to find (e.g. lizards, snakes etc). Give students a set time to be back (typically 30 minutes from the start but this depends on how many items they are looking for). Students must retrieve the items to prove that they found the locations of the coordinates

GPS treasure hunt

Worksheet

Names of those "finding" treasure

TEAM NAME_____

Individual names

_____ _____

_____ _____

_____ _____

Time used:_____

# of items found:_____

item 1: **Lat.**_____ **Long.**_____ **Accuracy** _____

item 2: **Lat.**_____ **Long.**_____ **Accuracy** _____

item 3: **Lat.**_____ **Long.**_____ **Accuracy** _____

item 4: **Lat.**_____ **Long.**_____ **Accuracy** _____

item 5: **Lat.**_____ **Long.**_____ **Accuracy** _____

Group No.	Names	Placed Trove No.	Found Trove No.	Time (min)
1	Nicole & Blake	10	9	9
2	Jason & Danielle	4	5	12
3	Quincy & Brian	12	15	14
4	Tiana & Chris I	11	7	7
5	Da'Sounta & Chris II	1	3	11
6	Da'Vounta & Luis	7	18	16.5
7	Mark & Dalton	8	8	10.5
8	David & Da'shante	6	4	20
9	Tonica & Darrian	3	12	12
10	Anthony & Jordan	9	11	12
11	Robert & Mia	2	16	10
12	Taneah & joe	5	14	7.5