---'Save As' this file using the name in the assignment instructions.
---Type you information.
---Submit the completed development plan via Blackboard with you other files.

NAME: J Hundley
ASSIGNMENT: assign05
DATE: March 7, 2012

PROBLEM SOLVING IN ENGINEERING AND SCIENCE
Always use a systematic problem-solving strategy.

1. STATE THE PROBLEM:
---Describe the problem to be solved for the assignment.
Read the heights of mountains on Earth and Mars from a text file.
Compute and print the mountain distance from the horizon.
Print the highest mountain on each planet.

2. DESCRIBE THE INPUT AND OUTPUT REQUIREMENTS:
---List and describe the following as needed to solve the problem, as needed.
---Include units where needed.

   CONSTANTS (known values that don't change):
diameter of the Earth is 7926 miles
diameter of the Mars is 4217 miles
data file name

   INPUT (values needed to find the output):
planet ID number
height of mountain (Mars in km, Earth in feet)
radius of each planet

   OUTPUT (unknowns)
maximum height of mountain on Mars
maximum height of mountain on Earth
distance to the horizon in miles

   OTHER VARIABLES

   Relevant formulas:
      (for complicated equations, it may be helpful to divide it into parts)
distant = sqrt(2rh + h^2)
miles = km / 1.609
miles = feet / 5280

3. WORK HAND EXAMPLES
---Solve the problem with a few hand examples.
---Record the input values used and the results

Mars   16.0 km 205.0 miles
Mars   18.0 km 217.5 miles
Earth 2392.0 ft   59.9 miles
Earth 20320.0 ft 174.7 miles

```
4. DEVELOP AN ALGORITHM:
---Think about the steps used to solve the problem to solve the problem by
   hand and list them here to create an algorithm.
---The algorithm steps should be used as comments in your program as a guide.
CONSTANT values
    Mars diameter(miles)
    Earth diameter(miles)
    filename
initialize counter and accumulators
table title and column headers
read first value in file; number of mountains
while there is data, read the values from data file using fscanf
    get planet radius(miles)
    convert height to miles
    check for new max height
    compute distance (miles) from horizon
    print table with planet number and
         mountain height and distance from horizon in miles
print highest mountain height (miles) of each planet

5. SOLVE THE PROBLEM:
---This step represents your writing a computer program to solve the problem.
---NOTE: Do not type your program here. Submit it as a computer program file.
---Use steps in your algorithm as comments in your program
   to guide the development of you program.

6. TEST THE SOLUTION:
---Run your program using the values from #3 to check for correctness.
---If there is an error, correct your program code and run again.
```

```
// J Hundley
// assign05
// Mar 7, 2012
/*
Read the heights of mountains on Earth and Mars from a text file.
Compute and print the mountain distance from the horizon.
Print the highest mountain on each planet.
*/

#include <stdio.h>
#include <math.h>
#define EARTH_DIAMETER 7926  // miles
#define MARS_DIAMETER  4217  // miles
#define FILENAME       "mountainHeights.txt"

    int main()
   {
      int    numMtn,          // number of planets (input)
             n,               // loop control
             planetNum;       // ID number for planet (inout)
      double mtnHt,           // height of mountain in km or feet (input)
             height,          // height of mountain in miles
             diameter,        // radius of planet in miles
             horizonDist;     // distance from mountain to horizon in miles (output)
   // initialize counter and accumulators
      double maxMarsHt = 0,  // max mountain height on Mars in miles (output)
             maxEarthHt = 0; // max maoutain height on Earth in miles (output)

      FILE * filePtr;

   // prepare file to read
      filePtr = fopen(FILENAME, "r");
      if (filePtr == NULL) printf("FILE OPEN ERROR. END PROGRAM.\n");
      else // good file open
      {
      // table title and column headers
         printf("Distance from Mountain Peak and Horizon\n");
         printf("Planet   Mountain    Horizon           \n");
         printf("Number    Height*   Distance*          \n");
         printf("------   --------   --------          \n");
```

```
      // read first value in file; number of mountains
      fscanf(filePtr, "%d", &numMtn);

   // read the values from data file using fscanf.
      for ( n=0; n<numMtn; n++ )
      {
         fscanf(filePtr, "%d", &planetNum);
         fscanf(filePtr, "%lf", &mtnHt);
      //printf("%d   %f", planetNum, mtnHt);

         switch (planetNum)
         {
            case 4: // Mars, mtnHt in km
               diameter = MARS_DIAMETER;
               height = mtnHt / 1.609;
               if ( height > maxMarsHt )
                  maxMarsHt = height;
               break;
            case 3: // Earth, mtnHt in feet
               diameter = EARTH_DIAMETER;
               height = mtnHt / 5280;
               if ( height > maxEarthHt )
                  maxEarthHt = height;
               break;
         } // end switch

      // compute distance from horizon
         horizonDist = sqrt( diameter * height + height * height );

      // print table with planet number and
      //   mountain height and distance from horizon in miles
         printf( "  %d      %6.1f      %6.1f \n", planetNum, height, horizonDist );
      } // for loop

   // table footer
      printf( "* Units = miles\n\n" );

   // print highest mountain height for each planet
      printf( "The highest mountain on Mars: %.1f miles\n",maxMarsHt );
      printf( "The highest mountain on Earth: %.1f miles\n",maxEarthHt );

   }  //end else

   return 0;
}
```

COMP1200-C - assign 05
Due midnight – Wednesday – March 7
Submit `assign05.c, mountainHeights.txt` and `devPlan05(.txt or .rtf)` **via Blackboard**

Before you start writing your program:

Use the template to create a Software Development Plan (`devPlan05.txt`) to plan your solution to the assign05 assignment problem.

NOTE: Your submitted file(s) MUST be spelled and cased as instructed.

***Program*: assign05.c**

Read all instructions before beginning your work.

The distance to the horizon increases as you climb a mountain (or a hill).The express

$$d = \sqrt{2rh + h^2}$$

The line is the top of a radical sign…square root sign.

where

d = distance to the horizon,
r = radius of the earth, and
h = height of the hill.

can be used to calculate that distance The distance depends on how high the hill is and the radius of the earth (or another planetary body). Read the heights (km or ft) from the data file. Print a table with columns: the planet number, mountain height (miles), and distance from the horizon (miles). Print the highest mountain on each planet at the end of the report.

The information about some of the mountains on Mars and Earth is stored in the text data file,

`mountainHeights.txt,`

where
11 is the number of mountains for loop control when reading,
4 and 3 are planet ID numbers to determine where the mountain is,
and the second column is the height of the mountains.

Note that
Earth's diameter is 7926 miles.
Mars' diameter is 4217 miles.

Mars, 4th planet from the sun Mons (mountain)	Height* (km)
Arsia Mons	16.0
Ascraeus Mons	18.0
Elysium Mons	12.5
Olympus Mons	27.0
Pavonis Mons	8.7

Earth, 3rd planet from the sun Mountains	Height* (ft)
Mount Everest	29029
Aconcagua	22841
Lookout	2392
McKinley	20320
Rainier	14410
Mitchell	6684

* http://en.wikipedia.org

***Problem Constants*:**
filename
earth_diameter is 7926 miles
mars_diameter is 4217 miles

New commands
`FILE *`
`fopen`
end program if not good open
`fscanf`
CONSTANT variables
#define

***Problem Inputs*:**

Problem Outputs:

Other variables:

Equations:

Algorithm:
(Use the algorithm in your development plan as comments in your program.)

Sample Input/Output:

```
Distance from Mountain Peak and Horizon
Planet    Mountain     Horizon
Number     Height*    Distance*
------    --------    --------
  4          9.9        205.0
  4         11.2        217.5
  4          7.8        181.2
  4         16.8        266.5
  4          5.4        151.1
  3          5.5        208.8
  3          4.3        185.2
  3          0.5         59.9
  3          3.8        174.7
  3          2.7        147.1
  3          1.3        100.2
* Units = miles

The highest mountain on Mars: 16.8 miles
The highest mountain on Earth: 5.5 miles
```

mountainHeights.txt

```
11
4 16.0
4 18.0
4 12.5
4 27.0
4 8.7
3 29029.0
3 22841.0
3 2392.0
3 20320.0
3 14410.0
3 6684.0
```

General Instructions:

- ☐ Insert comments at the top and throughout each file
  - Include the follow comments at the beginning of this (and ALL) files.
    - // your name
    - // assignment number
    - // date you completed the assignment
    - // **statement(s) about collaboration**
    - // a short narrative about what the file does
  - Use the algorithm as comments throughout each file
- ☐ Use descriptive variable names.
- ☐ Use Sample Input/Output as a guide.
  - Save the name of the data file as a CONSTANT.
  - Use title and column headers
  - One decimal place for height and distance
  - Print column numbers right-aligned
- ☐ Divide you solution program code into sections as noted in the algorithm. Use section comments as well as the algorithm step comments.
- ☐ Indent all blocks.

-7 points per file for absence of any of these required comments at the top

Submit via Blackboard:

`assign05.c`	m script program file
`devPlan05.txt` or `.rtf`	Development plan
`mountainHeights.txt`	The data file that you downloaded needs to be submitted so that there is a copy in your submission folder for your program to read.

CAUTION!!!

NOTE: Your submitted file(s) MUST be spelled and cased as instructed.