DEPARTMENT OF PHYSICS & ASTRONOMY
PHAS3459 Final Examination
10:00 - 13:00: 10th December 2014

Please read the exam guidelines, rules, instructions and marking criteria at
`https://moodle.ucl.ac.uk/mod/wiki/view.php?pageid=15228`
(linked from the *Examinations and coursework* page).

This exam is worth 50% of your final mark for the course. The duration of the exam is 3 hours.

Students should upload the Java source code files for their solution using Moodle under the section headed "Exam II".

The code you upload must be self-contained: the marker must be able to compile and run it using only the classes uploaded and the Java API. If you use your own classes from earlier modules, make sure you upload them as well as any new classes you create during the exam.

You are advised to read the entire exam paper before starting work.

In this examination you be processing some data from the UK Tide Gauge Network, supplied by the British Oceanographic Data Centre (BDOC).

The input data files are provided in the following web directory:
`http://www.hep.ucl.ac.uk/undergrad/3459/exam-data/2014-15/`. There are two types of files:

- Files with names like `tides-1999.txt` each contain records of the sea level recorded at different times and places during the given year. Each line contains the following fields, separated by white space:
  - an identifier for the site where the measurement was made
  - the year
  - the month (1–12)
  - the day of the month (1–31)
  - the hours part of the time (00–23)
  - the minutes part of the time (00–59)
  - the sea level in metres above a reference point
  - the predicted sea level, derived from a database of tidal constants maintained by the National Oceanography Centre's Application Group
- The file `sites.txt` contain information about the sites where sea level measurements were recorded. Each line (following the header) contains the following details of the site in question:
  - the name of the site;
  - the identifier of the site;

Part 1: 20/50 marks

Write a program to do the following:

- Read the data from the files detailed above, and store them in one or more appropriate data structures.
- Find the highest observed level in the tide data and print the following details:
  - the value of the highest observed level
  - the identifier and name of the site where this level was observed
  - the date and time when this level was observed

Part 2: 20/50 marks

- Create an interface to represent the calculation of an arbitrary statistic from a set of sea-level data, i.e. it should define a function that takes a list of sea-level readings (in some suitable form) as input and returns a real number.
- Create appropriate implementations and use them to calculate and print the following for each site:
  - the mean of all sea-level readings at that site;
  - the tidal range at that site, i.e. the difference between the highest and lowest reading taken at that site.

Part 3: 10/50 marks

- Print details (size, site, date and time) of the largest tidal *surge*, which is obtained by subtracting the predicted sea level at a location and time from the observed sea level at the same location and time.
- By reusing or adapting your code, or otherwise, repeat the previous calculation (finding the largest surge) for the data in `http://www.hep.ucl.ac.uk/undergrad/3459/exam-data/2014-15/part3/`. The format is similar to that of the data used earlier, but the site identifier is *after* the date and time fields instead of before.

END OF PAPER