The following are some IB pseudo code questions from past papers that include the use of arrays and/or collections.

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**13.** (a) By **copying** the table below, trace the following algorithm using the data in the collection `DATA`. **Note**: `B` and `C` are also collections and are initially empty.

```
DATA = {2,4,-1,3}
loop while DATA.hasNext()
  A = DATA.getNext()
  if A >= 0 then
    if A mod 2 = 0 then
      B.addItem(A)
    else
      C.addItem(A)
    end if
  end if
end loop
```

| DATA.hasNext() ? | A | A >= 0? | A mod 2 = 0? | Contents of B | Contents of C |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

[3]

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(c) A collection called `NUMBERS` is to be searched to see if it contains a specified value. Construct an algorithm in pseudocode to perform the following:

- input the number, `S`, to be searched for
- read in the values from the `NUMBERS` collection into the array `D`. **Note**: you can assume that the array is large enough and that the collection is **not** empty
- perform a linear search for `S` on the array `D`
- output the message "`found`" or "`not found`" as appropriate. [5]

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**15.** The collection `WEATHER` contains the temperatures that have been measured for one city over the course of **one week**, starting on Monday and ending on Sunday. Each day, 24 readings were taken, one each hour, the first being at 00:00, the second at 01:00 and so on. The data is stored in chronological order with the data for Monday stored in the collection first, followed by Tuesday and so on.

(a) State the total number of readings that were taken during this week. [1]

(b) Construct the algorithm to read this data into a 2D array, `A`, that would allow the temperature on a specific day at a specific time to be accessed directly. [4]

(c) Construct the algorithm that will output the day, as a word (for example Tuesday), on which the highest temperature was recorded. [6]

The process described at the start of question 15 is extended so that each week the value and date of the highest temperature recorded that week are stored chronologically in a collection, `HIGHEST`.

At any point in time, the data from the `HIGHEST` collection can be read into a suitable data structure that will allow the details of the highest temperatures recorded to be output in descending order. The structure is chosen in order to minimize processing.

(d) Explain how a suitable data structure can be constructed and used for this purpose. [4]

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**12.** (a) The collection `DATA` contains the following data:

2, 4, 1, –2, –4, 1, 0

Consider the following pseudocode:

```
COUNTER = 0
SUM = 0
DATA.resetNext()
loop for X from 0 to 6
  if DATA.getNext() > 0
    ARRAY[X] = DATA.getNext()
    COUNTER = COUNTER + 1
    SUM = SUM + ARRAY[X]
  end if
end loop
output SUM/COUNTER
```

Trace the pseudocode using the table below: [4]

| X | ARRAY[X] | COUNTER | SUM | output |
|---|---|---|---|---|
| | | | | |

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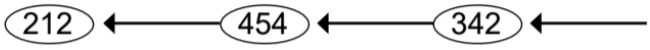
A transport authority is investigating how many people use a certain direct train route, which is used every day of the week.

At the end of each day, the total number of passengers who travelled on this route is stored in a collection, `PASSENGERS`.

The first item was written to the collection on Monday 1st January 2018.


The next items, collected on Tuesday and Wednesday, were added like this:




(b) Assuming that the first item read from the collection is from Monday 1st January 2018, construct pseudocode that will read `PASSENGERS` into an array, `P_ARRAY`. [4]

(c) Using `P_ARRAY`, construct pseudocode to output the day of the week with the highest average number of passengers. Use the sub procedure `convert()` which converts the numbers 0 to 6 into days of the week, for example `convert(1)` will return "Tuesday".

**Note:** you should <u>not</u> assume that data for an exact number of weeks is stored. [7]

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**11.** In a small airport, the details of all flights due to arrive on a particular day are held in a collection, `FLIGHTS`. Each object in the collection contains the following information:

`ID`: unique flight number
`PLACE`: where the plane is coming from
`DUE`: the time it is scheduled to arrive
`EXPECTED`: the time it is expected to arrive (only if it is early or if it is delayed)
`ARRIVED`: the time of actual arrival.

`EXPECTED` and `ARRIVED` are blank at the beginning of the day and the collection is sorted in order of `DUE`.

A screen in the airport can display information on 20 planes at a time, which are held in a linked list.

(a) Describe the features of a linked list of 20 planes that have the above information. [3]

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**16.** `Treatment` objects are being instantiated throughout the day and added to a collection. The object `treatmentFile` contains the following methods which act on that collection:

- `getNext()` which reads the next treatment from the collection and returns it
- `hasNext()` which returns false when there are no more treatments in the collection.

Construct the method `showMedicationByDoctor()`, which will take the name of a doctor as a parameter and output the medication for each treatment in the collection that has been provided by that doctor. You may assume that `treatmentFile` has been declared as a global variable, that it is open for reading, and that the first time `getNext()` is called it will return the first treatment from the collection. [6]