

Questions

Algorithms

1. A section of code in a program is designed to read and print records from a file. The file may contain any number of records (including zero).
Write an algorithm for this process. Justify the method of repetition used. [4]
2. The museum collects funds from many sources including entrance fees, purchases from the shop and restaurants, and donations. It also has to produce the payroll for staff and handle payments to suppliers.
Each of these financial applications is currently controlled by a separate system. The museum's board of governors has decided to commission a software house to produce an integrated package to handle all financial transactions.
The solution contains a number of modules. Three of the modules are
 - A module to input relevant data to the system
 - A module to calculate the pay for individual workers
 - A module to output payslips and electronic transfer of pay to workers' bank accountsState the parameters that would be passed between
 - (i) the input module and the pay calculation module,
 - (ii) the calculation module and the output module giving a reason why each parameter is necessary. [6]
3. A one-dimensional array, X, contains 6 integers in the range 0 to 99.
 - (a) Write an algorithm that will output the maximum and minimum values contained in X. [6]
 - (b) Use the following array and a trace table to illustrate how your algorithm works. [2]

X[1]	X[2]	X[3]	X[4]	X[5]	X[6]
16	31	89	15	42	5

Top-down/Modular design

1. A computer system is to be developed from a current manual system. The problem is to be solved by writing programs. A number of stages are necessary before programming can commence.
Explain top-down analysis and why it helps in the solution of complex problems. [4]
2. The new database system was designed by a systems analyst.
When the problem has been fully analysed, the analyst decides that a modular solution should be created.
Explain why a modular solution is chosen in preference to a single program. [4]
3. Top-down design is a technique used to produce solutions to complex problems.
 - (i) Explain the term top-down design. [3]
 - (ii) Explain three advantages of using top-down design to solve complex problems. [6]
 - (iii) Explain three techniques that can be used to ensure that program code is understandable and can be easily maintained. [6]
4. Explain the process of top-down analysis and explain why it helps in the solution of complex problems. [5]

Searching/Sorting

1. **An array, X, of integers has the following values stored in it:

X[1]	X[2]	X[3]	X[4]	X[5]
56	34	24	50	43

- (a) Using a trace table with columns labeled i, j, X[1], X[2], X[3], X[4] and X[5] show how the contents of array X are sorted into order when the following algorithm for a Bubble sort is followed:
- ```
set i=5
repeat
 for j=1 to i-1 do
 if X[j]>X[j+1] then
 swap X[j] and X[j+1]
 endif
 endfor
 set i=i-1
until i=2
```
- [8]
- (b) Rewrite the code so that the sort process terminates as soon as possible when the array is fully sorted. [3]
- (c) Give two different sets of test data that could be used to test the modified routine. Explain the purpose of each set of data. [4]
- (d) When deciding which sort method to use in a program give three factors that need to be considered. [3]
2. The company finds that it is using a large number of data files with its computer system.  
The company collecting the data in a single database and accessing it through a database management system.  
Each potential visitor has a record accessed by a unique 6 digit visitor number. The least significant digit of this number is a check digit.  
Sometimes the records need to be sorted into order, according to the values in one of the fields. There are a large number of records, so a Quicksort algorithm is used.  
Explain how a Quicksort works. [6]