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AS & A LEVEL

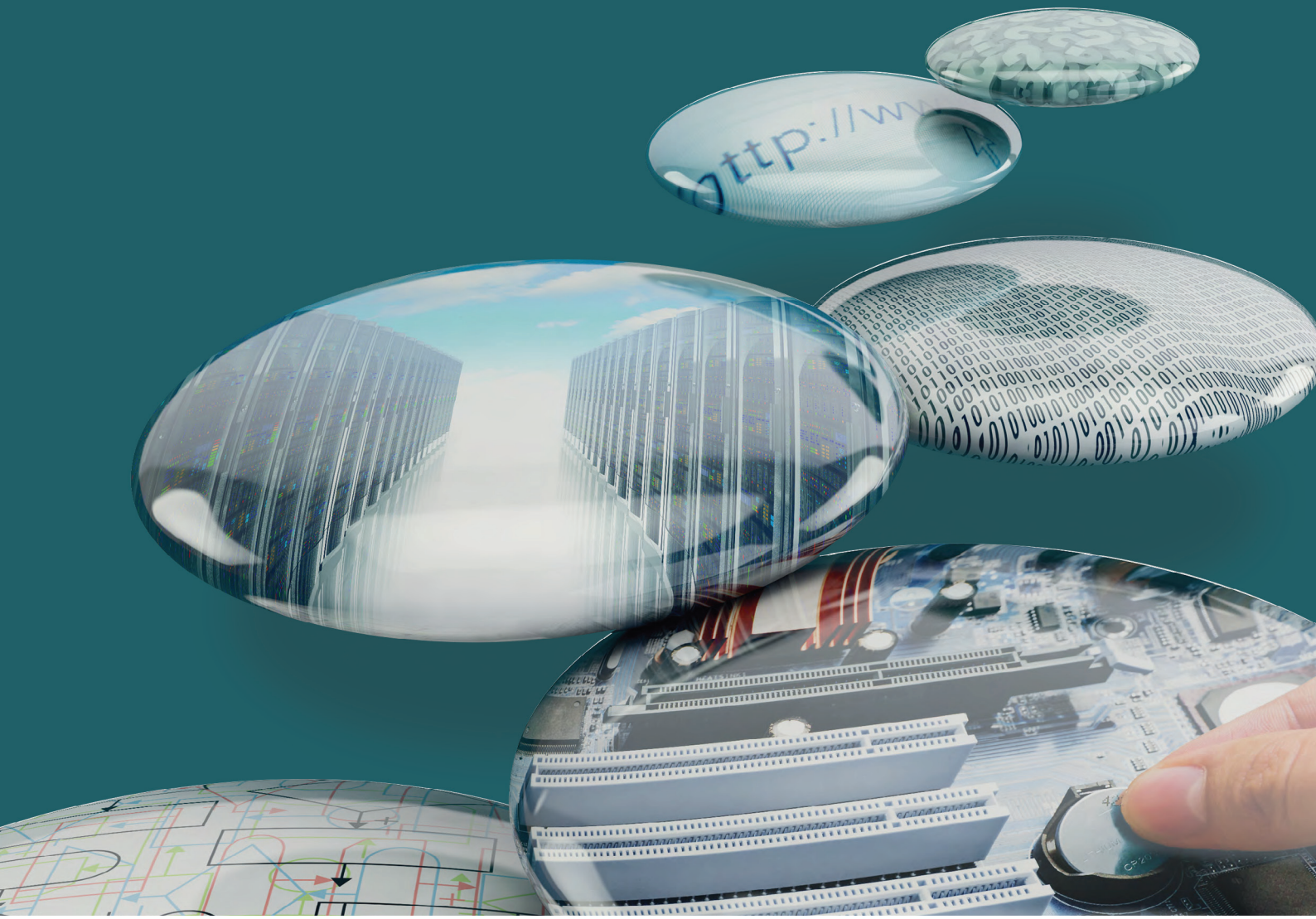
Topic Exploration Pack

H046/H446

COMPUTER SCIENCE

Theme: Computational Methods

September 2015



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Contents

This Topic Exploration Pack should accompany the OCR resource 'Computational Methods' learner activities, which you can download from the OCR website.

This activity offers an opportunity for English skills development.

Computational Methods

Here are general descriptions for the following tasks.
http://ocw.mit.edu/resources/res-tll-004-stem-concept-videos-fall-2013/videos/problem-solving/basic-programming-techniques/

http://www.cs.iit.edu/~cs100/ProblemSolving.pdf

Features that make a problem solvable by computational methods.

http://www.multiwingspan.co.uk/as1.php?page=problem

Problem Recognition. The first part of the system life cycle covers this, check problem to be solved is the actual problem to be solved and then …

Problem Decomposition. Top down design will cover both problem decomposition and divide and conquer.

Use of divide and conquer.

Task 1- Eating a biscuit

Create a divide and conquer diagram (top down design) for eating a biscuit (The biscuits are in the kitchen, in a sealed packet in a cupboard that is too high for you to reach)

Break down the steps for each task i.e. getting to the cupboard, opening the packet, putting the biscuits on a plate (they can't eat them out of the packet, it's not civilised).

Use of abstraction. OOP defining a generic data type for the purpose of sub classes that will be given concrete methods.

http://interactivepython.org/runestone/static/pythonds/Introduction/introduction.html
(about five 'clicks' down is a good bit about why use abstraction)

Task 2
Using a class diagram, create an abstract class called biscuit and decide what sub-types there could be. Will there be any sub-sub-types? Yes.

No real criteria for being a biscuit, used to be cakes were soft and biscuits were hard but then there came Jaffa cakes defined as a biscuit.

Suggestions if they have trouble getting started.
Digestives, chocolate digestives, milk chocolate or dark chocolate, milk chocolate with a plain biscuit or milk chocolate with a chocolate biscuit. Use ingredients for methods.
Size or shape could be an alternative way of dividing classes

Learners should apply their knowledge of :-

- **backtracking** – backtracking is used in a declarative type of programming language that will allow for more than one solution to be found, if a solution is found/not found the program will 'backtrack' and explore other paths/possibilities to try to find alternatives. http://www.cis.upenn.edu/~matuszek/cit594-2012/Pages/backtracking.html
- **data mining** - the process of looking for general trends in large sets of data. http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/datamining.htm
- **heuristics** - think about it and try different alternatives, use common sense, generalise rather than be specific. http://www.education.com/reference/article/problem-solving-strategies-algorithms/
- **performance modelling** - designing test criteria to see if a program/ task is successful or not. http://www.pmn.net/wp-content/uploads/logic-models-a-tool-for-telling-your-programs-performance-story.pdf
- **pipelining** – pipelining is the same as running a multi-tasking system, a task can be in one of three states: Running, where the task is being processed. Ready, where it waiting to be processed. Blocked, where it is awaiting an input. A possible way of utilising multi-core processors more efficiently. http://msdn.microsoft.com/en-us/library/ff963548.aspx http://link.springer.com/chapter/10.1007%2F978-3-642-24322-6_14#page-1
- **visualisation** - visualisation is used to give a different view in order to solve problems. http://www.google.co.uk/url?sa=t&rct=j&q=visualisation%20in%20programming%20methods&source=web&cd=4&cad=rja&uact=8&ved=0CEAQFjAD&url=http%3A%2F%2Fhrcak.srce.hr%2Ffile%2F69453&ei=6KY3VJWwEpPhaNS7gbgB&usg=AFQjCNELCK5fNDaXAF5a1VNkgzIdEqkFuA&bvm=bv.76943099,d.d2s

Task 3 – Backtracking

For steps to be shown working through the example students should use

Solution to first example:

Attempt to solve cake (X, Battenberg)
Finds X = Jeremy
Sets X = Jeremy
Backtracks to try to find another solution
Finds X = Kim
Sets X = Kim

Facts
Biscuits (Custard creams)
(Digestive)
(Garibaldi)
Cakes (Victoria sponge)
(Battenberg)
(Chocolate)

Eats (Anthony, Custard creams)
(Cilla, Digestive)
(Jeremy, Battenberg)
(John, Garibaldi)
(Kim, Battenberg)
(Roger, Victoria sponge)

Rules Likes biscuits Eats(X, Y) if Biscuits(Y)
Likes cake Eats(X, Y) if Cakes(Y)

Show the steps taken to get the results of:
Likes cake (X, Battenberg)
Likes biscuits (Roger, Y)
Likes cake (X, Chocolate)
Likes biscuits (X, Hobnobs)

Add another fact, another rule and a query using that rule.

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