Module 3
Searching and Sorting

Lesson 1 Where are you now?

Computers perform searching tasks all the time. In this lesson students will play a game and adopt strategies, similar to those used by computers, to search for an opponent's Battleship.

CD Resource

Projector

Group Work

Printable Resource

Lesson 2 Me First! Sorting

Computers are good at sorting vast amounts of information, such as financial data stored by banks. Students are introduced to the idea of efficient sorting. They perform a basic group activity to sort students by date of birth. They are introduced to 3 methods of sorting, using videos and a deck of cards.

CD Resource

Projector

Group Work

Printable Resource

Lesson 3 CSI – Finding Information on the Internet

Students are introduced to the various ways to search for information on the Internet. They follow an Internet treasure hunt to find answers to questions on various topics. Students learn how to evaluate the relevance and reliability of websites, using a Website Evaluation Form.

CD Resource

Projector

Group Work

Printable Resource

Computer

Internet

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Lesson 1 – Where Are You Now?[1]

Resources:
Battleships Game Packs (Resource 1), Searching For Information Using a Computer (Resource 2)

Key Vocabulary:
Linear Search, Binary Search, Hash Tables, Search Key

Description:
Students will play a game where they have to search for an opponent's Battleship to win. There are 3 versions of the game. The best strategy for game 1 is use of linear search. For game 2 the best strategy is a binary search. Game 3 uses a hash table to store the battleships. When the games are completed the differences between the 3 methods are presented and discussed. Uses of these searches by computers in our everyday lives are also outlined.

Learning Objectives:
1. To understand how to perform linear searches, binary searches and searches involving hash tables.
2. To understand how computers would process the 3 types of searches, and to understand when it is appropriate to use each type of search method.

Lesson Introduction:
Computers are often required to find answers to questions or look things up in large collections of data. It is tempting to think that the machine might as well simply search through all the data until the desired item is found (Linear Search). However, even on very fast computers, this is prohibitively slow in practice, because the quantities of data involved are often very large. This activity introduces the ideas underlying two widely-used techniques (Binary Searching and Hashing) that enable computers to search for data very quickly.

Lesson Breakdown:
1. Group the students into pairs. Each student is given a game pack (Resource 1). One member of each pair receives Game Pack A; the other receives Game Pack B. They should not show their sheets to each other.
2. For game 1 Battleships sheet 1A should play against Battleships sheet 1B.

[1] This lesson is based on Computer Science Unplugged Activity 16 - Searching Algorithms http://csunplugged.com

3. Each student circles one of the 26 battleships on the top section of their game sheet, and they tell their partner its four-digit number. This is "their" ship that the other student must try to "sink." E.g. on Battleships Sheet 1A if the ship with the letter "U" is circled then the partner should be told that the number of the ship is 4932.
4. The students then take turns guessing where their partner's circled ship is. They call out the letter corresponding to a location (A to Z), and their partner tells them the number of the ship at that letter. If the person who fires a shot "misses," they cross out the corresponding unnumbered ship on their sheet. E.g. If player B guesses battleship "C". Player A (Player A uses Battleships sheet 1A) calls ship number "3214" and "miss". Player B (Player B uses Battleships sheet 1B) will note "3214" and a "miss" on ship C that is located on the bottom section of their Battleships sheet.
5. The game finishes when both students have located their partner's ship. Their score for the game is the number of "shots" they fired (i.e. guesses they made), which is recorded on the game sheet. The spare sheets 1A', 1B' can also be used for this activity. They are provided for students who would like to play more games.
6. Once the students have finished this game, it is helpful to have a class discussion. Collect the scores. Point out the minimum and maximum number of shots fired, and ask what are the minimum and maximum possible (they are 1 and 26 respectively). Linear searching was used to complete this game.
7. For game 2 sheets 2A and 2B are used. The rules for this version of the game are the same. Explain to the students that because the numbers on the ships are now in ascending order a different strategy should be used to try and win the game more quickly. E.g. Player B is trying to hit Battle ship number "3972" and makes a guess of battleship "M". Player A (Player A uses Battleships sheet 2A) calls ship number "5031" and "miss". Player B (Player B uses Battleships sheet 2B) will note "5031" and a "miss" on ship "M" that is located on the bottom section of their Battleships sheet. Player B will guess a letter lower than "M" for their next guess as their target battleship "3972" is less than their guess of "5031". Sheets 2A' and 2B' can be used to play a second game.
8. After the game ask if the students think this game was easier than the first one. They should discover that, in this new version because the ships numbers are in order they are able to cross off several ships with one "shot." The best strategy is always to choose the middle of the region that must contain the ship. This is called binary searching. At each stage of the search you can eliminate half of the data that you are searching. Each shot halves the number of locations that the ship might occupy, and so we quickly narrow down its location. If the strategy is applied correctly, any ship can be found in five shots.
9. The third game, on sheets 3A and 3B, uses another strategy for locating ships quickly. Knowing the number of a ship, you can calculate which column (0 to 9) it is in. This is done by summing the digits of the ship number and taking the last digit of the result. An example comes with the handout. To locate a ship numbered 2345, add the digits

2+3+4+5, giving 14. The last digit of the sum is 4, so that ship must be in column 4. You must then guess which of the ships in column 4 is the one you are searching for. This searching technique is called hashing.

10. Collect and discuss the scores as before. Check that the students have realised that the new strategy is often faster than the previous one, but if there were a large number of ships in a column then it could still be slow to find the right ship in a chosen column. Ask which ships would be very quick to find (the ones that are alone in their columns) and which would be hard to find (the ones whose columns contain lots of other ships).
11. Once finished go through the PowerPoint presentation “Searching for Information Using a Computer” (Resource 2). This compares how computers would perform using the 3 types of searches investigated by the games, linear searching, binary searching and hashing.

Resource 1

Battleships Game Packs

A set of sheets for the battleships game.

My Ships

Number of Shots Used:

9058	7169	3214	5891	4917	2767	4715	674	8088	1790	8949	13	3014
A	B	C	D	E	F	G	H	I	J	K	L	M
8311	7621	3542	9264	450	8562	4191	4932	9462	8423	5063	6221	2244
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Player A Pack

1A

My Ships

Number of Shots Used:

6123	1519	9024	5164	2038	2142	7156	9974	9375	7104	1004	1023	5108
A	B	C	D	E	F	G	H	I	J	K	L	M
1884	3541	5251	4840	3289	3654	2480	5602	8965	4053	2405	2304	1959
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

1A′

My Ships

Number of Shots Used:

163	445	622	1410	1704	2169	2680	2713	2734	3972	4208	4871	5031
A	B	C	D	E	F	G	H	I	J	K	L	M
5283	5704	6025	6801	7440	7542	7956	8094	8672	9137	9224	9508	9663
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

2A

My Ships

Number of Shots Used:

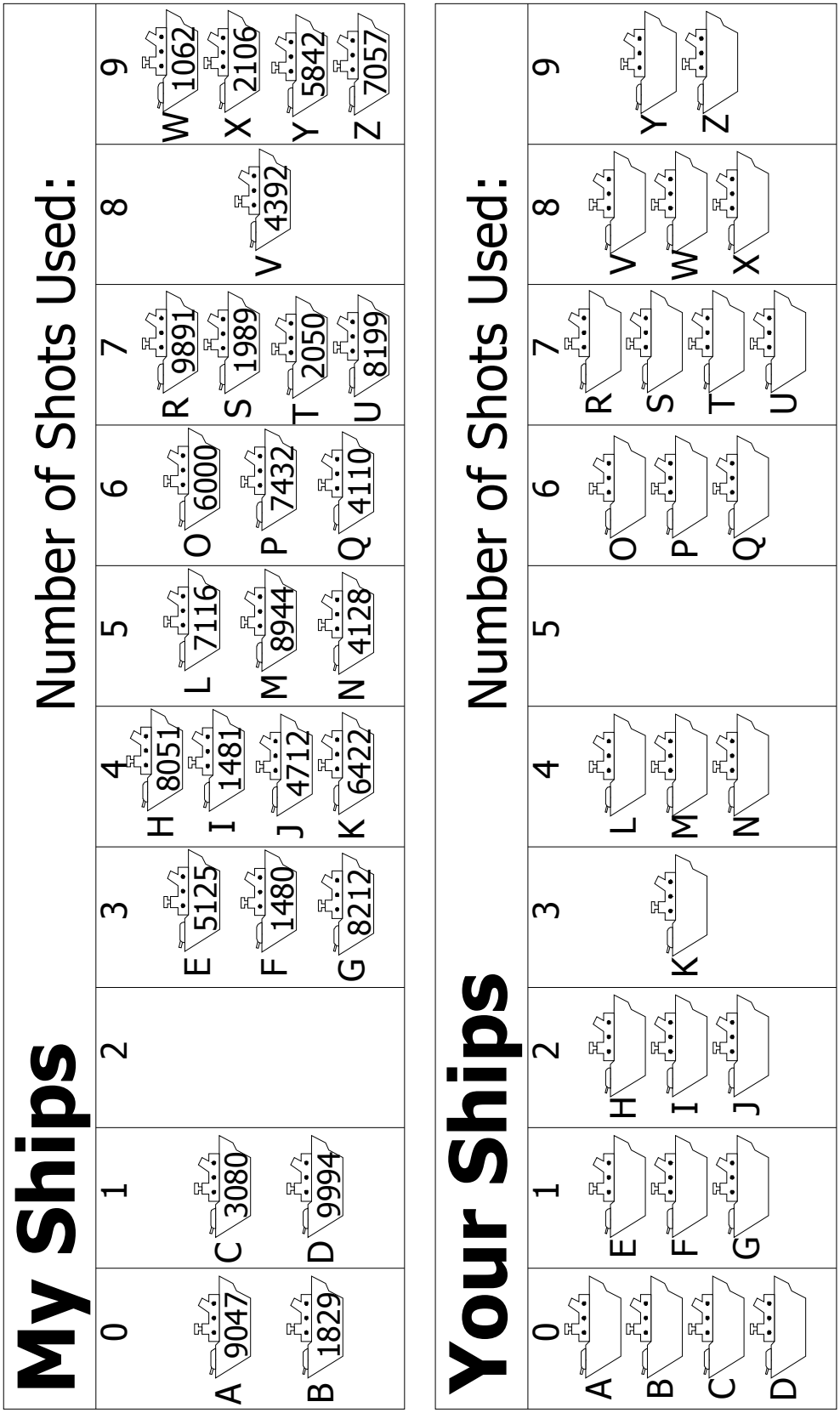
28	326	943	1321	1896	2346	2430	2929	3106	3417	4128	4717	4915
A	B	C	D	E	F	G	H	I	J	K	L	M
5123	5615	6100	7015	7120	7695	7812	8103	8719	9020	9608	9713	9911
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

2A′



3A

Example: To locate a ship numbered 2345, add the digits 2+3+4+5, giving 14. The last digit of the sum is 4, so that ship must be in column 4. The sheets are arranged so that the rule works for all ships.

My Ships

Number of Shots Used:

0	1	2	3	4	5	6	7	8	9
A 1982	C 6113		E 9121	H 5009	L 1248	O 2004	R 9369		W 9172
B 7841	D 1055		F 1011	I 2651	M 1716	P 5173	S 1321	V 3285	X 2052
			G 2984	J 1751	N 2148	Q 2806	T 3004		Y 6012
				K 4848			U 7190		Z 7525

Your Ships

Number of Shots Used:

0	1	2	3	4	5	6	7	8	9
A	E	H		L		O	R	V	
B	F	I	K	M		P	S	W	Y
C	G	J		N		Q	T	X	Z
D							U		

3A′

My Ships

Number of Shots Used:

1630	9263	4127	405	4429	7113	3176	4015	7976	88	3465	1571	8625
A	B	C	D	E	F	G	H	I	J	K	L	M
2587	7187	5258	8020	1919	141	4414	3056	9118	717	7021	3076	3336
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Player B Pack

1B

My Ships

Number of Shots Used:

2387	9003	3951	5695	1284	4761	7118	1196	1741	3791	3405	3132	6682
A	B	C	D	E	F	G	H	I	J	K	L	M
9493	9864	7359	1250	7036	2916	7562	9299	8910	6713	5173	8617	4222
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

1B′

My Ships

Number of Shots Used:

33	183	730	911	1927	1943	2200	2215	3451	3519	4055	5548	5655
A	B	C	D	E	F	G	H	I	J	K	L	M
5785	5897	5905	6118	6296	6625	6771	6831	7151	7806	8077	9024	9328
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

2B

My Ships

Number of Shots Used:

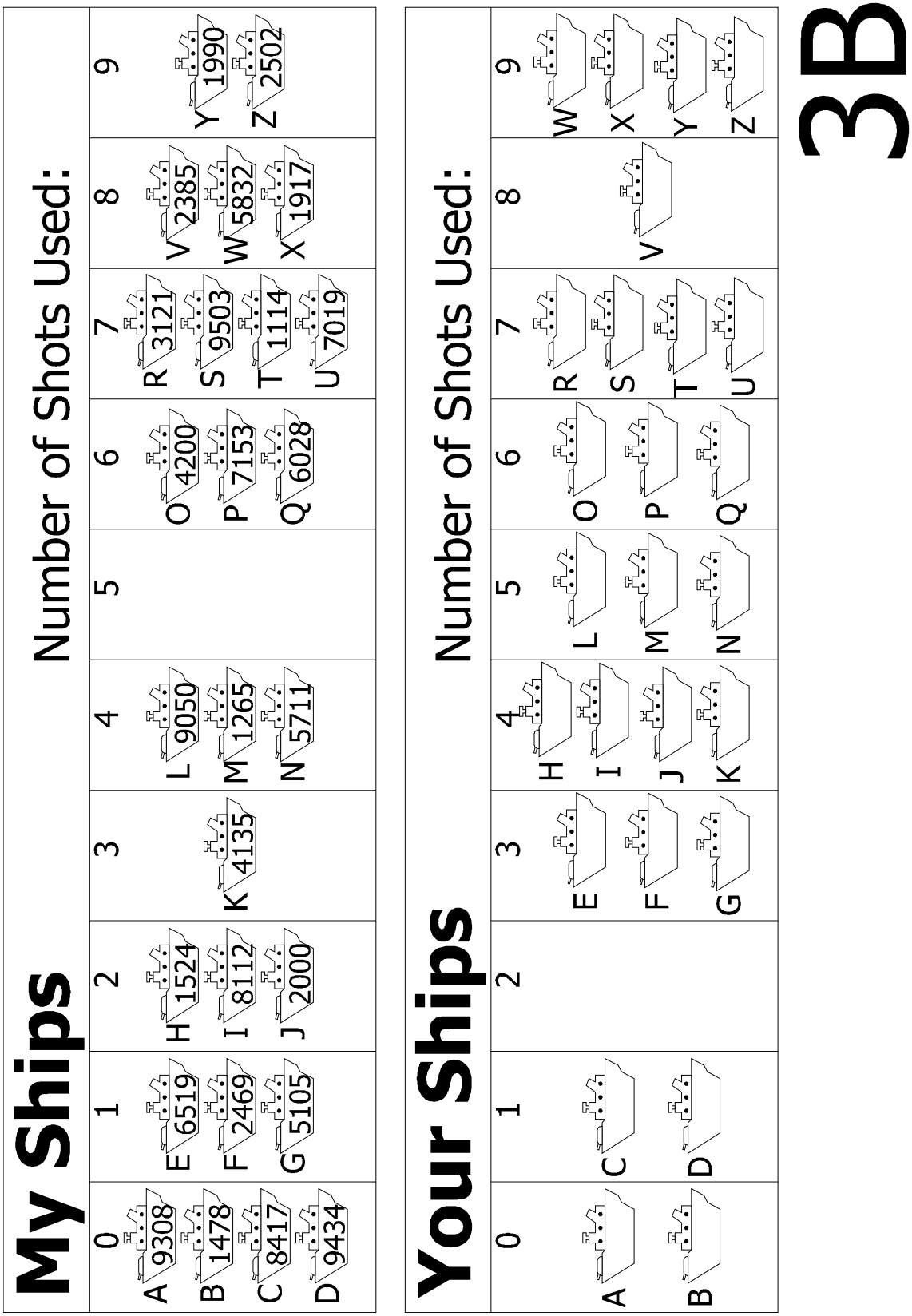
56	194	306	1024	1510	1807	2500	2812	3011	3902	4178	5902	5915
A	B	C	D	E	F	G	H	I	J	K	L	M
6102	6526	6818	7020	7155	7913	8016	8230	8599	8902	9090	9526	9812
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Your Ships

Number of Shots Used:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

2B′



Example: To locate a ship numbered 2345, add the digits 2+3+4+5, giving 14. The last digit of the sum is 4, so that ship must be in column 4. The sheets are arranged so that the rule works for all ships.

My Ships

Number of Shots Used:

0	1	2	3	4	5	6	7	8	9
A 8615	E 1361	H 7726	K 3000	L 1814		O 9656	R 6993	V 8208	Y 2917
B 7003	F 7644	I 9003		M 2002		P 4002	S 3121	W 9423	Z 4122
C 1991	G 5600	J 5557		N 8844		Q 1221	T 4300	X 4176	
D 6211							U 1907		

Your Ships

Number of Shots Used:

0	1	2	3	4	5	6	7	8	9
A	C		E	H	L	O	R	V	W
B	D		F	I	M	P	S		X
			G	J	N	Q	T		Y
				K			U		Z

3B′

Resource 2

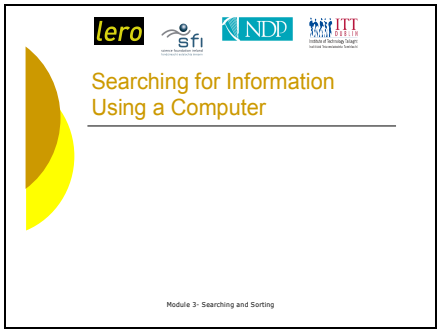
Searching for Information using a Computer

A PowerPoint slideshow guides the entire lesson

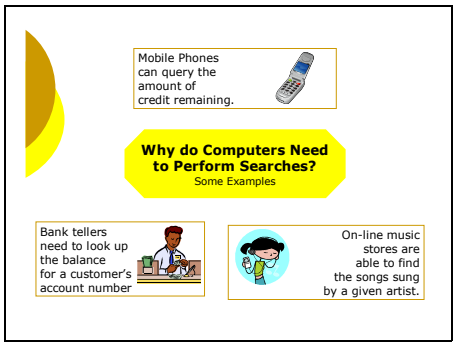
CD Resource

"M3L1R2 Searching for Information Using a Computer.ppt"

Slide 1

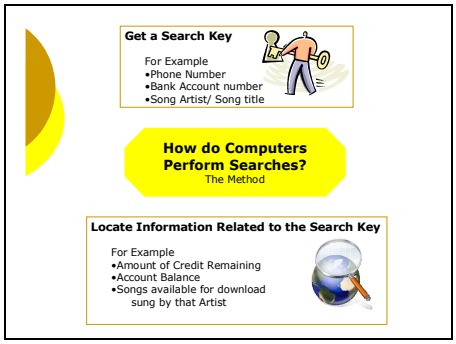


Slide 2



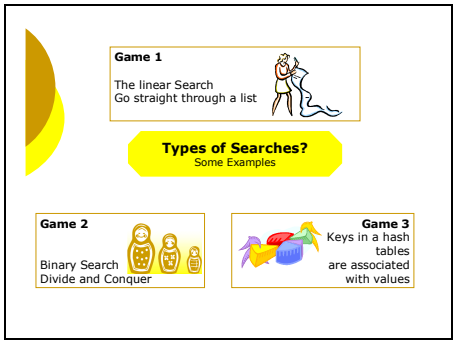
Computers are constantly performing searches to answer our questions.
E.g. How much phone credit do I have remaining?
What is my bank balance?
Show me songs from my favourite band that are available for download?

Slide 3



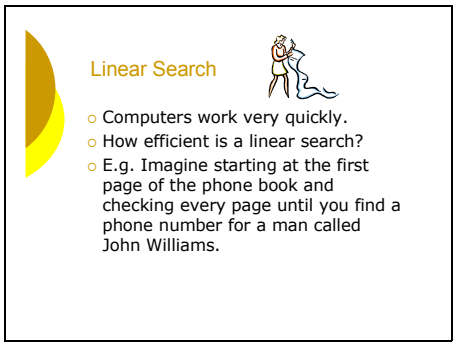
Computers can store lots of information. They need a method to sift through this information and locate what is required.

Slide 4



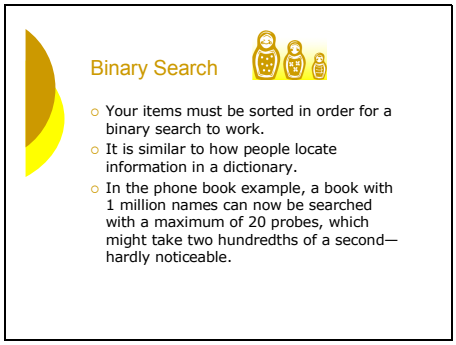
The battleships games from the lesson used 3 different types of searching strategies. This is a very quick reminder of how we searched using these strategies. The following slides will explain the methods used in more detail.

Slide 5



Even though computers are getting more and more efficient as technology advances, a linear search can be very slow. E.g. Imagine starting at the first page of the phone book and checking every page until you find a phone number for a man called John Williams. Even if it took just 1000th of a second to check each name it could take a few minutes to identify the number you are looking for using a linear search.

Slide 6



Using a binary search we check the middle item of the list to identify which half the search key is in. The process is repeated on each successive half until the list has been narrowed down to just one item.

Slide 7

Binary Search

	Number of Items in a list	Number of comparisons required in a binary search
2^1	2	1
2^2	4	2
2^3	8	3
2^4	16	4
2^8	256	8
2^{12}	4096	12
2^{16}	65,536	16
2^{20}	1,048,576	20
2^{30}	1,073,741,824	30

From this table you can see that the number of comparisons required for each search equals the log of the number of items being searched.
e.g. $\log_2 16 = 4$, $\log_2 256 = 8$ etc…

The time efficiency of the search depends on the number of comparisons used to locate the search item.

Slide 8

Game 3 - Hashing

- Data is stored at a specific location based on a hash function. Our game used a hash function to identify a column number for a ship. This column number (Hash Key) was created using the final digit of the sum of the digits of a ship's number.
- As you have seen, it was slow to find the right ship in a chosen column if there was a large number of ships in a column. However, it was very quick if there was just one ship in a column.
- Hashing can be used for searching through lists of unsorted information. For example the Hong Kong Book.

寿 = 7 禄 = 14

Until quite recently, the Hong Kong telephone directory worked like this: names were sorted into groups according to the number of strokes they contained, and having found the right group, you had to scan through it to find the name you wanted.
Computer programmers usually use some version of the hashing strategy for searching, unless it is important to keep the data in order, or if an occasional slow response is unacceptable—as in a life support system.

Lesson 2 – Me First! Sorting

Resources:
Bubble Sort Video (Resource 1), Selection Sort Video (Resource 2), Quicksort Video (Resource 3), Sheet with Cards (Resource 4) or a deck of cards, Files Worksheet (Resource 5), Bubble Sort versus Selection Sort in Scratch (Resource 6)

Key Vocabulary:
Sorting algorithm, Bubble Sort, Selection Sort, Quicksort / divide and conquer

Description:
Students are introduced to the idea of sorting. They perform a basic group activity to sort students by month of birth. They are introduced to 3 types of sorting methods: bubble sort, selection sort and quicksort using 3 short videos. **Note:** If there are problems playing the videos in a particular player, it is possible to download the **VLC** Media Player from the website http://www.videolan.org/vlc, as explained in Module 1, Lesson 1. This player is capable of reading most audio and video formats. Selected students perform each of the 3 types of sorts in turn, using either Resource 4 or a deck of cards. The 3 types of sorting methods are discussed and their efficiency or lack of efficiency is discovered. For the extension activity, students may then sort a number of computer files on paper, using Resource 5.

Learning Objectives:
1. To introduce students to the idea of sorting data in order.
2. To familiarise students with a number of sorting algorithms so that they understand that effective algorithms allow humans and computers to sort data faster.

Lesson Introduction:
Remind students that algorithms are sets of instructions to solve problems. Tell students that computers often order data, whether alphabetic, numeric, or by date. Many clever algorithms have been devised for putting values into order efficiently. If you use the wrong method, it can take a long time to sort a large list into order, even on a fast computer. Fortunately several fast methods are known for sorting. In this activity students will encounter different methods for sorting, and see how a clever method can perform the task much more quickly than a simple one.

Lesson Breakdown:
1. Discuss the computer science meaning of sorting (usually putting something into numeric or alphabetical order) and see if the students can think of places where putting things in order is important (such as

names in the telephone book, entries in a dictionary, the index of a book, the books on the shelves in a library, the letters in a postal worker's bag, names in an address book, a list of files on a computer).

2. Ask students to think about the consequences if these things were not in order (usually the problem is that it takes a long time to locate an object in an unsorted list). A linear search is usually required if the data is not ordered in some useful way (e.g. find a person's name in a phone book given their phone number).
3. Point out that sorting lists helps us find things quickly, and also makes extreme values easy to see. E.g. If you sort the marks for a class test into order, the lowest and highest marks become obvious.
4. Divide the class into small groups of between 6 and 10. Tell the students that they must organise themselves in a line in ascending order by month of birth. **But** the one constraint they have is that they cannot speak to each other for the duration of the exercise. This means they will have to use hand gestures etc. to decide on the order.
5. Once the activity has been completed by all groups, check the order by asking students to give their month of birth. Discuss the method of ordering the students used. Ask them how many comparisons they made before they were ordered correctly.
6. The students can now perform the same activity as a class. Once completed, discuss the difficulties arising when there is a larger amount of data involved and how efficiency may have been affected. Ask the students if they can suggest a more efficient method e.g. If one person holds up 6 fingers for the month of June and all others with birthdays in June go to this student's location.
7. Present students with the 3 videos on sorting (Resources 1, 2, 3): Bubble Sort, Selection Sort and Quicksort. Outline to students that these videos show sorting as processed in a methodical fashion like a computer. This is illustrated on a smaller scale using 8 playing cards, and discussion will follow after each video about how efficient each solution is on a larger scale. **Bubble Sort** works by repeatedly stepping through the lot of cards to be sorted, comparing 2 items at a time and swapping them around if they are in the wrong order. This is the least efficient method of the 3 although it works well enough for a small amount of data. **Selection Sort** works by examining all the cards on the table until the smallest value card is found. This card is then moved to the first position and the card that was already in the first position is placed in the gap. The remaining cards are continuously scanned in this manner, swapping the smallest card from the remaining cards to the second position, third position etc, until all cards are in ascending order from left to right. This is a more efficient method than bubble sort. **Quicksort** works by choosing a random card from a bundle and placing it in the centre of the table. The other cards are placed to the right or left of this card, depending on whether they are lower or higher than the card. A card is then chosen from one of these bundles and that bundle is sorted in the same manner, as is the last bundle. Quicksort is the most efficient method (divide and conquer).

8. After each video, ask 1 student to sit at a table at the top of the class and to perform a particular sort on a selected number of cards (Resource 4 or a selection of cards from a deck of cards).
   Note: Ensure the cards are shuffled before starting this activity.
9. Ask another student to record the number of moves / comparisons they make before they manage to put the cards in the correct order for each method above.
10. Revise the efficiency of each method. Remind students that computers use algorithms to sort data in order, and that it is clear from the 3 methods described in this lesson that a clever method can perform the task much more efficiently than a simple one.
11. Finally, show students a Scratch implementation of Bubble Sort versus Selection Sort, using the Scratch file PiratevsNinjaBubblevsSelection.sb (Resource 6). In this game, a pirate character performs a Bubble Sort on 5 numbers and a ninja character performs a Selection Sort on 5 numbers. This is repeated 4 times until a winner is declared. The winner is the character who performs the most efficient sort on the 5 numbers. You must select the 5 numbers for the characters to sort. Click on the 'Show project notes' button (see Module 1, Lesson 2 for instructions on how to locate this button) once you open the project in Scratch to see instructions on how the animation works. Explain to students that they do not need to understand the scripts at this stage as they are complex for a beginner in Scratch but that maybe when they have more experience in Scratch they will be able to design their own implementations of the sorting methods discussed in this lesson.

Extension activity

1. Give students the Files Worksheet (Resource 5). The cards list the drive letter, file location, file name and extension. Ask students to "sort them", stating that there will be many different ways to sort the cards, for example:
   - by drive letter
   - by folder
   - alphabetically by file name
   - alphabetically by extension
   - those with suitable file names
   - those saved in suitable locations

2. As a further extension activity the students could attempt to write an algorithm in simple English for the bubble sort algorithm.

Example of a bubble sort could be:

1. Compare first two elements.

2. If they are not in order, swap them.

3. Step through the list and compare next two elements.

4. Repeat steps 2&3 until you reach the end of the list.

5. Repeat steps 1-5 until no swaps are required.

Resource 1

Bubble Sort Video

A video that displays the Bubble Sort method, using a deck of cards.

CD Resource

"M3L2R1 Bubble Sort.mpg"

Resource 2

Selection Sort Video

A video that displays the Selection Sort method, using a deck of cards.

CD Resource

"M3L2R2 Selection Sort.mpg"

Resource 3

Quicksort Video

A video that displays the Quicksort method, using a deck of cards.

CD Resource

"M3L2R3 Quicksort.mpg"

Resource 4

Sheet with Cards

A sheet with numbered cards to be cut out (alternatively use a deck of cards).

The cards below can be cut out before the sorting tasks begin.

5	13
14	7
21	24
17	26
9	30

Resource 5

Files Worksheet

Worksheet with 12 computer file cards for use with the Extension activity. These can be cut out before sorting.

The cards can be cut out before sorting begins.

S:\STUFF.MAGIC.JPG	S:\STUFF\FOOTBALLSCORES.XLS
S:\STUFF.TXT	H:\SUBJECTS\SCIENCE\BEACH.PPT
H:\PERSONAL\PLAN.DOC	H:PERSONAL\MUMS.DOC
H:\SUBJECTS\SCIENCE\FROGS.JPG	H:\SILLYSOUND.MP3
S:\FRIENDS.JPG	H:\THINGS.TXT
S:\STORIES.DOC	S:\BEETLES.BMP
H:\PERSONAL\MATHSTEST.XLS	H:\SUBJECTS\MATHS\SCIENCEPROJECT.DOC
S:SCHOOL\PROJECT.HTM	H:\SUBJECTS\MATHS\SETS.TXT

S:\SCHOOL\PICTURE.BMP	**S:\SCHOOL\RESEARCH.HTM**
S:\BASKETBALLPROJECT.PPT	**H:\PRIMARYCOLOURS.BMP**
H:\SCHOOL\TREES.DOC	**S:\SUBJECTS\MATHS\FRACTIONS.XLS**
S:\SUBJECTS\MATHS\PROJECT.BMP	**H:\PERSONAL\PIN-NUMBERS.TXT**

Resource 6

Bubble Sort versus Selection Sort in Scratch

A fun implementation of Bubble Sort versus Selection Sort in Scratch.

CD Resource

“M3L2R6 PiratevsNinjaBubblevsSelection.sb”

Lesson 3 – CSI
Finding Information on the Internet

Resources:
CSI – Finding Information on the Internet (Resource 1), Internet Treasure Hunt Activity Sheet (Resource 2), Website Evaluation Form (Resource 3)

Key Vocabulary:
Search engine, Boolean search, Spider

Description:
Students are introduced to the idea of a search engine and the various ways to search for information on the Internet. Students engage in an Internet treasure hunt to find answers to questions on various topics. Students learn how to evaluate the relevance and reliability of websites, using a Website Evaluation Form.

Learning Objectives:
1. To introduce students to strategies on how to use Internet search engines more effectively and to find information more easily on the Internet.
2. To provide students with ways of evaluating the information retrieved on the Internet and to decide what is relevant and reliable.

Lesson Introduction:
- Tell students that today they will look at different ways of searching for information on the Internet.
- Ask students what search sites they have used when looking for information on the Internet. Ask students what they like about these sites and ask them to explain why they use them? Reasons for using the site may or may not be related to its search functions.
- Ask students why is it a good idea to try more than one search site? (Because no one search site covers the entire Web. Also, search sites offer different search options.)

Lesson Breakdown:
1. Start PowerPoint presentation (Resource 1).
2. Explain the term “search engine” to students and tell them that every major search engine has information about millions and millions of World Wide Web sites. At the click of a button, a search engine sorts through what it knows and lists the sites it thinks are relevant to your search. In some ways, a search engine is like a well-trained dog. It will fetch what you want, but only if you use the right commands.

3. Explain how search engines use spiders, special programs which "crawl" the Internet methodically and store information about web pages. Each time a web page is updated the spider will detect this and store the new version of a web page. When you perform your search it is this data stored by the spider that is used to construct a response to your search. This is why the response times to your search queries are so quick.
4. Explain to students that when entering key words into the search box of a search engine site, more words are better. Adding more key words helps the search engine put the results that are most relevant to you on the first page of the search results screen and fetches fewer hits.
5. Ask students if they can name any search engines e.g.
   http://www.ask.com
   http://www.google.com
   http://search.yahoo.com.
   Note: Some search engines will redirect the user to a local version of the search interface e.g. (www.google.ie).
6. Firstly ask students to search for something that interests them on one of the search engines mentions (e.g. their school, local clubs, favourite singer etc.)
7. Explain to students that when they put inverted commas "" around a few words or a phrase, the search engine will only retrieve documents in which these words appear side by side. E.g. "transition year". Ask students to use a search engine such as www.google.com to search for <transition year> without using inverted commas. Then ask them to search for <transition year> using inverted commas. Students should note the difference in the order in which the results are presented. You should notice that searching for "transition year" should return more relevant links in the first one or two pages of search results. Ask them to note the number of search results on the screen for the two different search terms. Students can repeat this exercise for other topics/search terms of their choice. **Note:** Make sure that students can locate where the number of results is displayed (usually top right-hand corner) on the screen.
8. Explain the term Boolean Search. Explain that the operators in Boolean searching will help the students to refine their search and to get more relevant results. Explain that the Boolean operators And, Or, Not can also be written as +, /, -.
   Ask the students to conduct a search on a topic of their choice using And (+) and NOT (-) commands in combination with key words, as well as using the Or (/) command. The students type a plus sign (+) in front of any keywords that must appear in the sites retrieved. Emphasise that the more keywords added, the more specific the results will be. Ask the students to type a minus (-) sign in front of keywords not wanted in the sites retrieved. This strategy will also limit the number of sites retrieved. Try this search item manchester +football or dublin +shopping +street.
   N.B. ***Make sure students type a space before the sign but not between the sign and the word to which it refers*****.**

9. Ask the students to combine the inverted commas approach with the Boolean operators e.g. “irish stew” +lamb will cause the search engine to retrieve results where the words “irish stew” appear side by side and the word “lamb” appears somewhere on the page. Students can try other examples themselves.
10. Show students how to find a particular word on a long web page, using the “Find on this page” function (Shortcut = **Ctrl F**).
11. Show students how to find particular images, using the images link on http://www.google.com. For example they could search for images of their own town or city and see what results are displayed.
12. Start Internet Treasure Hunt. Give students instructions on the activity sheet (Resource 2). Students unscramble the first letters of all 8 answers to find the magic word ‘Simulate’.
13. Students must now discover how to evaluate information on the Internet. Tell students that respected books, magazines, and journals go through many stages of development, involving authors, editors, designers, proofreaders, peer reviewers and publishers. This means that print resources contain accurate, useful information. Ask students how they think the way information published on the Internet is different from printed books, magazines, and journals? The idea is that anyone can author and publish a website, while traditional publishing has many layers of approval, including editing.
14. Ask students for suggestions on how they might decide if the information on a webpage is reliable or trustworthy. Explain to students some of the steps they can use to evaluate a webpage.
15. Give the students the Webpage Evaluation Form (Resource 3) and ask them to evaluate a site of their choice from the Internet using this sheet. Explain to the students how using this checklist may prevent them from using poor quality sites and getting inaccurate or unreliable information. Explain any questions students may find difficult.
16. Finally, using the 2 discussion questions at the end of the Website Evaluation Form, ask students which questions on the Evaluation Form they think are the most important and why.

Extension activity

Students may be divided into pairs to evaluate a site used regularly by one of their classmates, using the questions on the Website Evaluation Form.

Resource 1

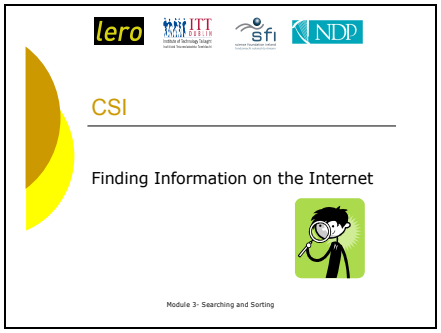
CSI – Finding Information on the Internet

A PowerPoint Presentation to guide the entire lesson.

CD Resource

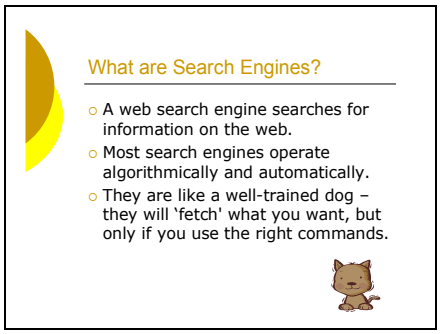
"M3L3R1 Finding Information on the Internet.ppt"

Slide 1



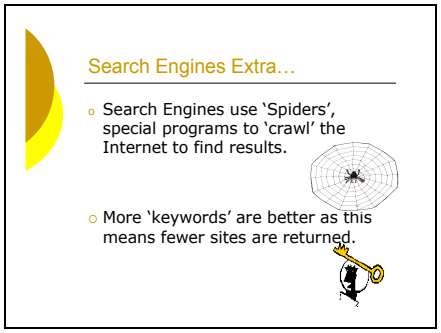
Introduce topic

Slide 2



Web search engines search for information on the Web.
At the click of a button, a search engine sorts through what it knows and lists the sites it thinks you are looking for. Most search engines operate algorithmically and automatically.
In some ways, a search engine is like a well-trained dog. It will fetch what you want, but only if you use the right commands.

Slide 3

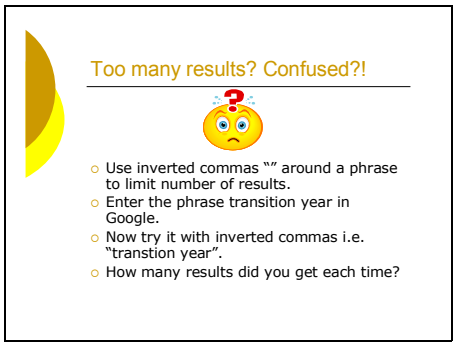


Search engines use spiders, special programs which "crawl" over the Internet to find results for your search.
When entering key words into the search box of a search engine site, more words are better. A search for a single word may "fetch" a million sites. It is obviously difficult to check a million sites to find the most relevant one for you.

Slide 4

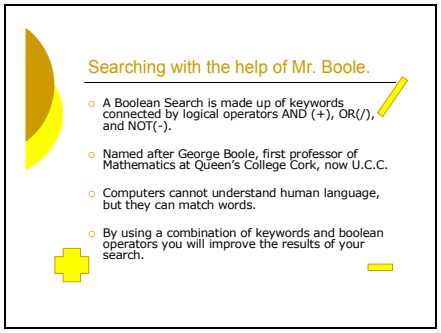
Ask students to name any search engines they know or use.

Slide 5



When you put inverted commas "" around a few words or a phrase, the search engine will only retrieve documents in which these words appear side by side. E.g. "transition year".
Try entering the phrase "transition year" into Google, first without inverted commas and then with inverted commas.
Note the number of sites retrieved each time.

Slide 6

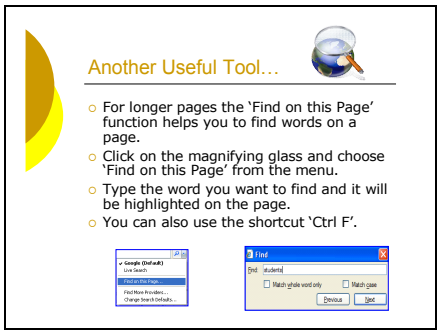


George Boole was the first professor of Mathematics at University College Cork.
A Boolean search, named after him involves using keywords, together with logical operators And, Or, Not.
Operators in Boolean searching will help you to refine your search and to get more relevant data to your search.
Boolean operators And, Or, Not can also be written as +, /, -.
Using a combination of keywords and boolean operators will improve the results of your search.

Slide 7

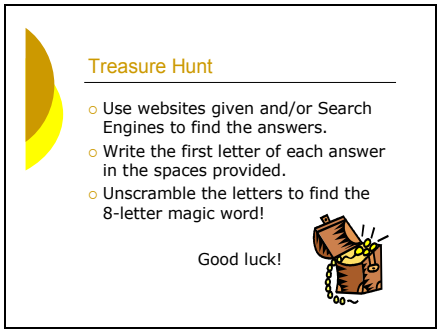
Try these examples listed, using the different search engines listed.
Compare the number of results retrieved with and then without inverted commas and boolean operators.
You should get a smaller number of results when you use the inverted commas and boolean operators.

Slide 8



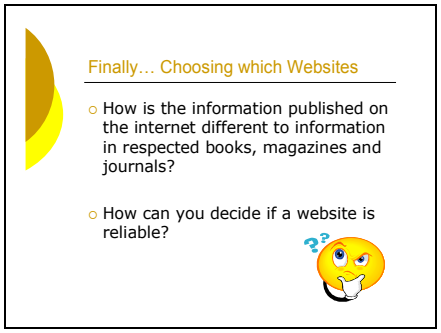
A useful tool to use pages containing a lot of text is the 'Find on this page' function.
When you type the word you are looking for into the box, it is highlighted on the page.
You can also use the shortcut option 'Ctrl F'.

Slide 9



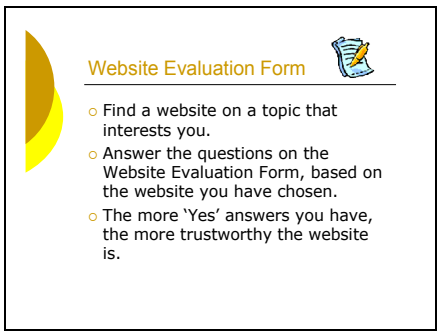
You are now going to go on a Treasure Hunt on the Internet. The treasure is the 8-letter magic word at the end.
On the sheet in front of you, you will see 8 questions.
Use the websites given and a search engine such as Google to find the answers.
Write the first letter of each answer in the spaces provided on your sheet and then unscramble them to find the magic word.

Slide 10



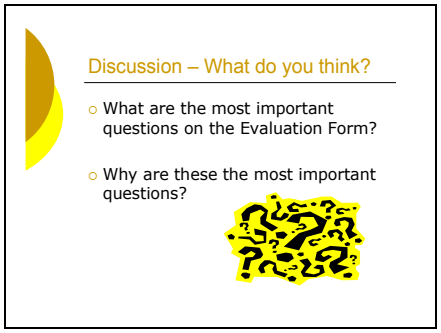
You know that respected, books, magazines, and journals go through many stages of development, involving authors, editors, designers, proofreaders, and publishers. This means that print resources contain accurate, useful information.
How do you think information published on the Internet is different?
How can you know if a website is trustworthy or reliable?

Slide 11



Choose a website from the Internet on a topic that interests you. It can be a site you know already.
Answer the questions on the Website Evaluation to evaluate the website you have chosen.
The more 'Yes' answers you have at the end, the more reliable the website is.
Using this checklist may prevent you from using poor quality sites and getting inaccurate or unreliable information.

Slide 12



Finally, what do you think are the most important questions on the form and why?

Resource 2

Internet Treasure Hunt Activity Sheet

A worksheet with questions to guide the treasure hunt.

Internet Treasure Hunt Activity Sheet

You are going on a treasure hunt on the Internet. You will use various web sites, including search engines to find the answers to the questions below.

- Use the Internet to find the answers to questions 1 – 8.
- Write down the answers.
- When you have found all the answers, write the first letter of the answers in the spaces provided below.
- You must unscramble these letters to give you an 8-letter magic word.

Good luck!

1. What is the main colour of the Latvian flag? Be careful, you need to research this one carefully!
   Answer: _____

2. Go to the TG4 website and navigate to the 'weather' section. Find the Irish word for 'presenters'. You may need to point at pictures!
   Answer: _____

3. Go to the Irish energy efficiency website 'Power of One'. In its energy saving tips for 'at home', what should you do with your phone charger?
   Answer: _____

4. Find a web site with a list of world currencies. Use the "Find on this Page" function (Shortcut = **Ctrl + F**) to find Somalia and then write the currency of Somalia.
   Answer: _____

5. Use the web site http://www.bubl.ac.uk to find a Dutch language for Beginners website. On this website find the Dutch word for 'elbow'.
   Answer: _____

6. What is the medical term for fear of flying?
   Answer: _____

7. Go to the Irish Government website http://www.irlgov.ie/. What government department deals with road, rail, air and maritime services?
   Answer: _____

8. Name the waterfall at the border of Argentina, Brazil and Paraguay.
   Answer: _____

Letters 1 – 8 (First letters of all your answers):

____ ____ ____ ____ ____ ____ ____ ____

Magic Word Unscrambled:

_____

Internet Treasure Hunt - Teacher's Answers:

1. Maroon
2. Laithreoirí
3. Unplug
4. Somali Shilling
5. Elleboog
6. Aerophobia
7. Transport
8. Iguazu

Letters 1 – 8:

M L U S E A T I

Magic Word Unscrambled:

S I M U L A T E

Resource 3

Website Evaluation Form

Complete the Website Evaluation Form to evaluate the website chosen by the student.

Evaluating Websites

Remember, anyone can be an author on the Internet. Creators of websites do not have to be experts in any subject and their facts don't have to be true. All you really need to be an author on the Internet is knowledge of how to build a website. It's up to you to judge which sites are good and which sites are not. So, which websites should you trust? What websites will meet your needs?

1. Choose a topic that interests you. Find a web site on this topic - you may use a search engine.
2. Answer the following questions to help you decide whether or not you should use the site for information.

Purpose of the Site	Circle one	Explain?
Can you tell if the site is fact or opinion? (If the information seems one-sided, or biased, you will have to go elsewhere to hear the other side of the issue.)	Yes No	
Is the site free of advertising?	Yes No	
Is a large proportion of the website covered with ads?	Yes No	
Is the site sponsored by any organisations?	Yes No	
Is the tone calm and fair? (Sites that are hateful and angry may not be a good source of information).	Yes No	
Is the site open to everyone or are there fees, passwords, registration etc.?	Yes No	

Trustworthiness of the author	Circle one		Explain
Is the author identified by name?	Yes	No	
Can the author be contacted if you have any questions? (E-mail address, postal address, phone number)	Yes	No	
Is the author's place of work or the organisation he/she belongs to given?	Yes	No	
Is the site's domain .edu (educational organisations), .com (businesses), .org (usually non-profit organisations), or .gov (government agencies)? (If you see a ~ in the website address, it may be a personal site, not an official site). You can also see .ie (Ireland) / .uk (United Kingdom) etc. as the domain. These are not tightly regulated, however.	Yes	No	
Was this site recommended by a site you trust?	Yes	No	
Is the site without spelling, typographical, and grammatical errors?	Yes	No	

Up to date information	Circle one		Explain
Is the date the article, page, or site was created given?	Yes	No	
Is the date the site was last updated given?	Yes	No	
Do all the links lead to active pages?	Yes	No	

Usefulness of Information	Circle one		Explain
Does this site have enough information for your search?	Yes	No	
Is most of the information useful for your research? (If not, it may be hard to find what you do need.)	Yes	No	

Ease of Use	Circle one		Explain
Is the text understandable?	Yes	No	
Do the titles and headings give a clear idea of the content?	Yes	No	
Does the website include a site map that provides an overall view of how the website is structured?	Yes	No	
Is there a tool for searching the site?	Yes	No	
Are the web links labelled clearly and do they accurately describe the sites they are pointing to?	Yes	No	

Discussion

1. How many 'Yes' answers did you circle?
2. What are the most important questions in this evaluation, in your opinion, and why?

Adapted from the 'Identifying High Quality Sites' form at http://www.cybersmartcurriculum.org/lesson_plans

References

Lesson 1
Resource 2
Slide 5
http://www.paked.net/subject_pages/computer_science/prog5.htm
Slide 6
http://www.paked.net/subject_pages/computer_science/prog1.htm
Slide 5
Knuth, D. The Art of Computer Programming, Volume 3: Sorting and Searching, Chapter 6.4. Addison Wesley, 1973

Lesson 2
Resource 5
http://pdchandler.wikispaces.com/Concept+Attainment
Resource 6
http://scratch.mit.edu

Lesson 3
Resource 3
http://www.cybersmartcurriculum.org/lesson_plans/k1_05.asp