Worksheet: Binary Search Example

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1. A teacher has a sorted list of names from a class, as shown below. For each stage, write "`s`" for the start index, "`m`" for the middle index, and "`e`" for the end index in order to identify the stages of a ***binary search*** to find the name "**Jackson**" in the list. In order to calculate the middle index, use: `(start+end) DIV 2`. The indices of the array are written above the first stage to help you. (Page 30, question 6)

a)

0	1	2	3	4	5	6	7	8	9
Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
s				***m***					*e*

b)

Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
					s		***m***		*e*

c)

Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
					s, ***m***	*e*			

d)

Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
						s, ***m***, *e*			

e) How many times did the algorithm need to compare two names before it was able to find the name "Jackson"?

4

It is always the middle element that is compared, notice the four highlighted "m" in the table.

2. Now find the name "**Linton**" in the list using the same process. Again, calculate the middle index with: `(start+end) DIV 2`.

a)

0	1	2	3	4	5	6	7	8	9
Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
s				***m***					*e*

b)

Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
s	***m***		*e*						

c)

Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
		s, ***m***	*e*						

d)

Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall

e) How many times would the algorithm need to compare two names in order to find the name "Linton"?

3

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2. Now show how the binary search algorithm would search for the name "Johnson" in the list, calculating the middle using: `(start+end) DIV 2`. Note that the element is not in the list and the algorithm determines this when `start > end`.

	0	1	2	3	4	5	6	7	8	9
	Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
a)	*s*				***m***					*e*
b)						*s*		***m***		*e*
c)						*s*, ***m***	*e*			
d)							*s*, ***m***, *e*			
e)							*e*	*s*		

f) How many time would the algorithm need to compare two names before exiting if the list was searched for the name "Johnson"? ***4***

4. Show how the binary search algorithm would search for the name "Nielsen" in the list, calculating the middle using: `(start+end) DIV 2`. Note that the element is, again, not in the list. (7)

	0	1	2	3	4	5	6	7	8	9
	Azikewe	Bloom	Byrne	Davidson	Gateri	Hinton	Jackson	Linton	Smith	Wall
a)	*s*				***m***					*e*
b)						*s*		***m***		*e*
c)									*s*, ***m***	*e*
d)								*e*	*s*	

e) How many time would the algorithm need to compare two names before exiting if the list was searched for the name "Nielsen"? *Hint:* the answer is not the same as part (3f). ***3***