

Exercise 1F

1 a The middle name is the $\left(\frac{8+1}{2} = 4.5\right)$ 5th name:

5 Tapner

Connock is before Tapner so the list reduces to:

1 Berry

2 Connock

3 Li

4 Sully

The middle name is the $\left(\frac{4+1}{2} = 2.5\right)$ 3rd name:

3 Li

Connock is before Li so the list reduces to:

1 Berry

2 Connock

The middle name in this sublist is the $\left(\frac{2+1}{2} = 1.5\right)$ 2nd name:

2 Connock

The search is complete as Connock has been found.

b The middle name is the $\left(\frac{8+1}{2} = 4.5\right)$ 5th name:

5 Tapner

Walkey is after Tapner so the list reduces to:

1 Walkey

2 Wilson

3 Wu

The middle name is the $\left(\frac{3+1}{2} = 2\right)$ 2nd name:

2 Wilson

Walkey is before Wilson so the list reduces to:

1 Walkey

The search is complete as Walkey has been found.

c The middle name is the $\left(\frac{8+1}{2} = 4.5\right)$ 5th name:

5 Tapner

Peabody is before Tapner so the list reduces to:

1 Berry

2 Connock

3 Li

4 Sully

The middle name is the $\left(\frac{4+1}{2} = 2.5\right)$ 3rd name:

3 Li

Peabody is after Li, so the list reduces to:

1 Sully

There is only one item on the list and it is not Peabody therefore Peabody is not on the list.

2 a The middle number is the $\left(\frac{12+1}{2} = 6.5\right)$ 7th number:

7 15

21 is after 15 so the list reduces to:

1 17

2 18

3 20

4 21

5 24

The middle number is the $\left(\frac{5+1}{2} = 3\right)$ 3rd number:

3 20

20 is before 21 so the list reduces to:

1 21

2 24

The middle number is the $\left(\frac{2+1}{2} = 1.5\right)$ 2nd number:

2 24

24 is after 21 so the list reduces to:

1 21

The search is complete as 21 has been found.

b The middle number is the $\left(\frac{12+1}{2} = 6.5\right)$ 7th number:

7 15

5 is before 15 so the list reduces to:

1 3

2 4

3 7

4 9

5 10

6 13

The middle number is the $\left(\frac{6+1}{2} = 3.5\right)$ 4th number:

4 9

5 is before 9 so the list reduces to:

1 3

2 4

3 7

The middle number is the $\left(\frac{3+1}{2} = 2\right)$ 2nd number:

2 4

5 is after 4 so the list reduces to:

1 7

The search is complete as 5 has not been found.

- 3 a** Each search reduces the list to half its original size.

So starting with 100 items:

100 50 25 12.5 ...

This is a geometric sequence of the form $n = 100(0.5)^s$

Where n is the number of items remaining and s is the number of searches completed.

To find the number of searches required for $n = 1$

$$100(0.5)^s = 1$$

$$0.5^s = 0.01$$

$$s \ln 0.5 = \ln 0.01$$

$$s = \frac{\ln 0.01}{\ln 0.5}$$

$$= 6.643\dots$$

Therefore 7 searches are required.

- 3 b Each search reduces the list to half its original size.

So starting with 1000 items:

1000 500 250 125 ...

This is a geometric sequence of the form $n = 1000(0.5)^s$

Where n is the number of items remaining and s is the number of searches completed.

To find the number of searches required for $n = 1$

$$1000(0.5)^s = 1$$

$$0.5^s = 0.001$$

$$s \ln 0.5 = \ln 0.001$$

$$s = \frac{\ln 0.001}{\ln 0.5}$$

$$= 9.965\dots$$

Therefore 10 searches are required.

- c Each search reduces the list to half its original size.

So starting with 10 000 items:

10 000 5000 2500 1250 ...

This is a geometric sequence of the form $n = 10\,000(0.5)^s$

Where n is the number of items remaining and s is the number of searches completed.

To find the number of searches required for $n = 1$

$$10\,000(0.5)^s = 1$$

$$0.5^s = 0.0001$$

$$s \ln 0.5 = \ln 0.0001$$

$$s = \frac{\ln 0.0001}{\ln 0.5}$$

$$= 13.287\dots$$

Therefore 14 searches are required.

- 4 a The correct order is:
Adam, Alex, Des, Doug, Ed, Emily, Felix, George, Hongmei, Jess,
Katie, Lei, Leo, Lottie, Lotus, Matt, Miranda, Oli, Ramin, Saul

- b i The middle name is the $\left(\frac{20+1}{2} = 10.5\right)$ 11th name:

11 Katie

George is before Katie so the list reduces to:

1 Adam

2 Alex

3 Des

4 Doug

5 Ed

6 Emily

7 Felix

8 George

9 Hongmei

10 Jess

The middle name is the $\left(\frac{10+1}{2} = 5.5\right)$ 6th name:

6 Emily

George is after Emily so the list reduces to:

1 Felix

2 George

3 Hongmei

4 Jess

The middle name is the $\left(\frac{4+1}{2} = 2.5\right)$ 3rd name:

3 Hongmei

George is before Hongmei so the list reduces to:

1 Felix

2 George

The middle name is the $\left(\frac{2+1}{2} = 1.5\right)$ 2nd name:

George

George has been found.

4 b ii The middle name is the $\left(\frac{20+1}{2} = 10.5\right)$ 11th name:

11 Katie

David is before Katie so the list reduces to:

1 Adam

2 Alex

3 Des

4 Doug

5 Ed

6 Emily

7 Felix

8 George

9 Hongmei

10 Jess

The middle name is the $\left(\frac{10+1}{2} = 5.5\right)$ 6th name:

6 Emily

David is before Emily so the list reduces to:

1 Adam

2 Alex

3 Des

4 Doug

5 Ed

The middle name is the $\left(\frac{5+1}{2} = 3\right)$ 3rd name:

3 Des

David is before Des so the list reduces to:

1 Adam

2 Alex

The middle name is the $\left(\frac{2+1}{2} = 1.5\right)$ 2nd name:

Alex

David is after Alex.

Since there are no names after Alex, David is not on the list. The search is over.

4 b iii The middle name is the $\left(\frac{20+1}{2} = 10.5\right)$ 11th name:

11 Katie

Jess is before Katie so the list reduces to:

1 Adam

2 Alex

3 Des

4 Doug

5 Ed

6 Emily

7 Felix

8 George

9 Hongmei

10 Jess

The middle name is the $\left(\frac{10+1}{2} = 5.5\right)$ 6th name:

6 Emily

Jess is after Emily so the list reduces to:

1 Felix

2 George

3 Hongmei

4 Jess

The middle name is the $\left(\frac{4+1}{2} = 2.5\right)$ 3rd name:

3 Hongmei

Jess is after Hongmei so the list reduces to:

1 Jess

Jess has been found. The search is over.