Shell sort: → Very Similar to "insertion sort"

how many element → "n"

gap:

1st gap → $\frac{n}{2}$ = gap

ex n = 8

gap = $\frac{8}{2}$ = 4 → we need to test with '4' gap

2nd step = gap = $\frac{gap}{2}$

gap = $\frac{4}{2}$ = 2 → we test all the all

gap > 0

Shell sort

$n = 10$

0	1	2	3	4	5	6	7	8	9
4	22	34	8	112	134	64	18	20	21

Step 1: gap $= \frac{10}{2} = 5$

0	1	2	3	4	5	6	7	8	9 ✓ n
4	22	18	8	21	134	64	34	20	112

1) $(0, 0+5) = (0, 5) \Rightarrow (4, 134) \rightarrow$ No swap

2) $(1, 6) \Rightarrow (22, 64) \Rightarrow$ No swap

3) $(2, 7) \Rightarrow (34, 18) \Rightarrow$ swap

$(2-5, 2) \rightarrow (-3, 2) \rightarrow$ invalid operation $\rightarrow$ stop

4) $(3, 8) \rightarrow (8, 20) \rightarrow$ No swap

⑤ $(4, 9) \rightarrow (112, 21) \rightarrow$ swap

$(4-5, 4)$

$(-1, 4) \rightarrow$ invalid $\rightarrow$ stop.

0	1	2	3	4	5	6	7	8	9
4	22	18	8	21	134	64	34	20	112

Newgap $\Rightarrow \frac{gap}{2} \Rightarrow \frac{5}{2} = \lfloor 2.5 \rfloor \Rightarrow 2$

0	1	2	3	4	5	6	7	8	9
4	8	18	22	~~21~~ 20	~~134~~ 34	~~64~~ ~~20~~ 21	~~134~~ 112	64	134

Previous gap = 5

8) $\Rightarrow$ (7, 9) $\Rightarrow$ (134, 112) → Swap

↓

(7-2=5, 7) $\Rightarrow$ (34, 112) → No swap → Stop

9) (8, 10) → invalid

1) (0, 0+2) $\Rightarrow$ (0, 2) $\Rightarrow$ (4, 18) → No swap.

2) (1, 3) $\Rightarrow$ (22, 8) → Swap

(1-2, 1) $\Rightarrow$ (-1, 1) → invalid → Stop

3) (2, 4) $\Rightarrow$ (18, 21) → No Swap

4) (3, 5) $\Rightarrow$ (22, 134) → No Swap

5) (4, 6) $\Rightarrow$ (21, 64) → No Swap

6) (5, 7) → (134, 34) → Swap.

↓

(5-2, 5) → (22, 34) → No swap → Stop

(3, 5)

7) (6, 8) $\Rightarrow$ (64, 20) → Swap

↓

(6-2=4, 6) $\Rightarrow$ (21, 20) → Swap.

↓

(4-2=2, 4) $\Rightarrow$ (18, 20) → No swap → Stop

0	1	2	3	4	5	6	7	8	9
4	8	18	22	20	34	21	112	64	134

Previous gap = 2

New gap = gap = $\frac{2}{2} = 1$

0	1	2	3	4	5	6	7	8	9
4	8	18	~~22~~ 20	~~22~~ 21	~~34~~ ~~21~~ 22	34	~~112~~ 64	112	134

1) (0,1) → (4,8) → X (No swap)

2) (1,2) → (8,18) → X

3) (2,3) → (18,22) → X

4) (3,4) → (22,20) → ✓

(3-1/2, 3) → (18,20) → X (stop)

5) (4,5) → (22,34) → X

6) (5,6) → (34,21) → ✓✓

(5-1/4, 5) → (22,21) → ✓

(3,4) → (20,21) → X (stop)

7) → (6,7) → (34,112) → X

8) → (7,8) → (112,64) → ✓

(6,7) → (34,64) → X (stop)

9) (8,9) → (112,134) → X

10) (9,10) → invalid index → stop the process

newgap = $\frac{PG}{2} = \frac{1}{2} = \lfloor 0.5 \rfloor \Rightarrow (0)$

5+0

1000

gap > 0