# Tracing While Loops









### Consider...

```
int i = 4, j = 1, n = 0;
while (i > j) {
    if (n % 2 == 0) {
        i--;
    } else {
        j++;
    }
    n++;
}
```

```
int i = 4, j = 1, n = 0;
                                i = 4
                                             j = 1 \qquad \qquad n = 0
while (i > j) {
  if (n % 2 == 0) {
    i--;
  } else {
    j++;
  n++;
```

```
int i = 4, j = 1, n = 0;
                            i = 4
                                        j = 1
                                                    n = 0
while (i > j) {
                            i = 4
                                        j = 1
                                                    n = 0
 if (n % 2 == 0) {
   i--;
  } else {
   j++;
 n++i
```

```
int i = 4, j = 1, n = 0;
                             i = 4
                                         j = 1
                                                     n = 0
while (i > j) {
                             i = 4
                                         j = 1
                                                     n = 0
 if (n % 2 == 0) {
                             i = 4
                                         j = 1
                                                     n = 0
   i--;
  } else {
   j++;
 n++i
```

```
int i = 4, j = 1, n = 0;
                             i = 4
                                         j = 1
                                                      n = 0
while (i > j) {
                             i = 4
                                         j = 1
                                                      n = 0
 if (n % 2 == 0) {
                             i = 4
                                         j = 1
                                                      n = 0
   i--;
                             i = 3
                                         j = 1
                                                      n = 0
  } else {
    j++;
 n++;
```

```
int i = 4, j = 1, n = 0;
                               i = 4
                                             j = 1
                                                          n = 0
while (i > j) {
                               i = 4
                                             j = 1
                                                          n = 0
  if (n % 2 == 0) {
                               i = 4
                                             j = 1
                                                          n = 0
    i--;
                               i = 3
                                             j = 1
                                                          n = 0
  } else {
                               i = -
                                             j = -
                                                          n = -
    j++;
                               i = -
                                             j = -
                                                          n = -
                               i = 3
                                             j = 1
                                                          n = 0
  n++;
```

```
int i = 4, j = 1, n = 0;
                                i = 4
                                             j = 1
                                                          n = 0
while (i > j) {
                                i = 4
                                             j = 1
                                                          n = 0
  if (n % 2 == 0) {
                                i = 4
                                             j = 1
                                                          n = 0
    i--;
                                i = 3
                                             j = 1
                                                          n = 0
  } else {
                                i = -
                                             j = -
                                                          n = -
    j++;
                                i = -
                                             j = -
                                                          n = -
                                i = 3
                                             j = 1
                                                          n = 0
  n++;
                                i = 3
                                             j = 1
                                                          n = 1
```

```
int i = 4, j = 1, n = 0;
                                i = 4
                                              j = 1
                                                           n = 0
while (i > j) {
                                i = 4 3
                                              j = <del>1</del> 1
                                                           n = \theta 1
  if (n % 2 == 0) {
                                i = 4
                                              j = 1
                                                           n = 0
    i--;
                                i = 3
                                              j = 1
                                                            n = 0
  } else {
                                i = -
                                              j = -
                                                            n = -
    j++;
                                i = -
                                              j = -
                                                            n = -
                                i = 3
                                              j = 1
                                                            n = 0
  n++;
                                i = 3
                                              j = 1
                                                            n = 1
```

```
int i = 4, j = 1, n = 0;
                                 i = 4
                                              j = 1
                                                            n = 0
while (i > j) {
                                 i = 4 3
                                              j = <del>1</del> 1
                                                            n = \theta 1
  if (n % 2 == 0) {
                                 i = 4 -
                                              j = \pm - n = \oplus -
    i--;
                                 i = <del>3</del> −
                                              j = ± −
                                                            n = \theta -
  } else {
                                 i = -3
                                              j = -1 \qquad \qquad n = -1
    j++;
                                 i = -
                                               j = -
                                                            n = -
                                 i = 3
                                               j = 1
                                                            n = 0
  n++;
                                 i = 3
                                               j = 1
                                                            n = 1
```

```
int i = 4, j = 1, n = 0;
                                i = 4
                                              j = 1
                                                           n = 0
while (i > j) {
                                i = 4 3
                                              j = <del>1</del> 1
                                                           n = \theta 1
  if (n % 2 == 0) {
                                i = 4 -
                                              j = \pm - n = \oplus -
    i--;
                                i = <del>3</del> −
                                              j = <del>1</del> −
                                                           n = \theta -
  } else {
                                i = -3
                                             j = -1 \qquad \qquad n = -1
    j++;
                                i = -3
                                              j = -2
                                                           n = -1
                                i = 3
                                              j = 1
                                                           n = 0
  n++;
                                i = 3
                                              j = 1
                                                           n = 1
```

```
int i = 4, j = 1, n = 0;
                                  i = 4
                                                j = 1
                                                              n = 0
while (i > j) {
                                  i = 4 3
                                                j = <del>1</del> 1
                                                              n = \theta 1
  if (n % 2 == 0) {
                                  i = 4 -
                                                j = \pm - n = \oplus -
    i--;
                                  i = <del>3</del> −
                                                j = <del>1</del> −
                                                              n = \theta -
  } else {
                                  i = -3
                                                j = -1 \qquad \qquad n = -1
    j++;
                                  i = -3
                                                j = -2
                                                             n = -1
                                  i = \frac{3}{3}
                                                j = <del>1</del> 2
                                                              n = \theta 1
  n++;
                                  i = 3
                                                j = 1
                                                              n = 1
```

```
int i = 4, j = 1, n = 0;
                                 i = 4
                                               j = 1
                                                             n = 0
while (i > j) {
                                 i = 4 3
                                               j = <del>1</del> 1
                                                            n = \theta 1
  if (n % 2 == 0) {
                                 i = 4 -
                                               j = \pm - n = \oplus -
    i--;
                                 i = <del>3</del> −
                                               j = ± −
                                                            n = \theta -
  } else {
                                 i = -3
                                               j = -1 \qquad \qquad n = -1
    j++;
                                 i = -3
                                               j = -2
                                                            n = -1
                                 i = \frac{3}{3}
                                               j = <del>1</del> 2
                                                             n = \theta 1
  n++;
                                 i = <del>3</del> 3
                                               j = \pm 2 n = \pm 2
```

```
int i = 4, j = 1, n = 0;
                                 i = 4
                                               j = 1
                                                             n = 0
while (i > j) {
                                 i = 4 \Rightarrow 3 j = \pm \pm 2 n = 0 \Rightarrow 2
  if (n % 2 == 0) {
                                 i = 4 -
                                               j = 4 - n = 4 -
    i--;
                                 i = <del>3</del> −
                                               j = ± −
                                                             n = \theta -
  } else {
                                 i = -3
                                               j = -1 \qquad \qquad n = -1
    j++;
                                 i = -3
                                               j = -2
                                                             n = -1
                                 i = <del>3</del> 3
                                               j = <del>1</del> 2
                                                             n = \theta 1
  n++;
                                 i = <del>3</del> 3
                                               j = \pm 2 n = \pm 2
```

```
int i = 4, j = 1, n = 0;
                                i = 4
                                              j = 1
                                                           n = 0
while (i > j) {
                                i = 4 \Rightarrow 3 j = \pm \pm 2 n = 0 \pm 2
  if (n % 2 == 0) {
                                i = 4 - 3 j = 4 - 2 n = 9 - 2
    i--;
                                i = <del>3</del> −
                                             j = \frac{1}{2} - n = \frac{1}{2} - n
  } else {
                                i = -3 j = -1 n = -1
    j++;
                                i = -3 i = -2 n = -1
                                i = <del>3</del> 3
                                             j = <del>1</del> 2
                                                           n = \theta 1
  n++;
                                i = <del>3</del> 3
                                             j = \pm 2 n = \pm 2
```

```
int i = 4, j = 1, n = 0;
                               i = 4
                                           j = 1 n = 0
while (i > j) {
                               i = 4 \Rightarrow 3 j = \pm \pm 2 n = 0 \pm 2
 if (n % 2 == 0) {
                               i = 4 - 3 j = 4 - 2 n = 4 - 2
    i--;
                               i = \frac{3}{2} - 2 j = \frac{1}{2} - 2 n = \frac{1}{2} - 2
  } else {
                               i = -3 j = -1 n = -1
    j++;
                               i = -3 i = -2 n = -1
                               i = \frac{3}{2} 3 j = \frac{1}{2} 2 n = \frac{1}{2} 1
 n++;
                               i = 3 j = 12 n = 12
```

```
int i = 4, j = 1, n = 0;
                                                                                                                                                                                                                                                                                  i = 4
                                                                                                                                                                                                                                                                                                                                                                                                 i = 1 n = 0
while (i > j) {
                                                                                                                                                                                                                                                                                 i = 4 \Rightarrow 3 j = \pm \pm 2 n = 0 \pm 2
                 if (n % 2 == 0) {
                                                                                                                                                                                                                                                                                 i = 4 - 3 j = 4 - 2 n = 9 - 2
                                   i--;
                                                                                                                                                                                                                                                                                  i = 3 - 2 i = 4 - 2 n = 9 - 2
                    } else {
                                                                                                                                                                                                                                                                                 j++;
                                                                                                                                                                                                                                                                                  i = -3 - j = -2 - n = -1 - 1
                                                                                                                                                                                                                                                                                  i = \frac{3}{3} = \frac{3}{2} = \frac{1}{2} = \frac{2}{2} = \frac{2}{2} = \frac{1}{2} = 
                 n++;
                                                                                                                                                                                                                                                                                   i = \frac{3}{3}  j = \frac{1}{2}  n = \frac{1}{2}
```

```
int i = 4, j = 1, n = 0;
                                                                                                                                                                                                                                                                              i = 4
                                                                                                                                                                                                                                                                                                                                                                                            j = 1 n = 0
while (i > j) {
                                                                                                                                                                                                                                                                              i = 4 \Rightarrow 3 j = \pm \pm 2 n = 0 \pm 2
                 if (n % 2 == 0) {
                                                                                                                                                                                                                                                                              i = 4 - 3 j = 4 - 2 n = 9 - 2
                                   i--;
                                                                                                                                                                                                                                                                              i = 3 - 2 i = 4 - 2 n = 9 - 2
                   } else {
                                                                                                                                                                                                                                                                              j++;
                                                                                                                                                                                                                                                                              i = -3 - j = -2 - n = -1 - 1
                                                                                                                                                                                                                                                                              i = \frac{3}{3} = \frac{3}{2} = \frac{1}{2} = \frac{2}{2} = \frac{2}{2} = \frac{1}{2} = 
                 n++;
                                                                                                                                                                                                                                                                               i = 3 + 2 j = 4 + 2 n = 4 + 3
```

```
int i = 4, j = 1, n = 0;
                                                                                                                                                                                                                                                                                                                                                                               i = 1 n = 0
                                                                                                                                                                                                                                                                     i = 4
while (i > j) {
                                                                                                                                                                                                                                                                    i = 4 \Rightarrow 3 j = \pm \pm 2 n = 0 \Rightarrow 2
                if (n % 2 == 0) {
                                                                                                                                                                                                                                                                     i = 4 - 3 j = 4 - 2 n = 9 - 2
                                  i--;
                                                                                                                                                                                                                                                                     i = \frac{3}{2} - 2 j = \frac{1}{2} - 2 n = \frac{1}{2} - 2
                   } else {
                                                                                                                                                                                                                                                                    j++;
                                                                                                                                                                                                                                                                     i = -3 - j = -2 - n = -1 - 1
                                                                                                                                                                                                                                                                     i = \frac{3}{3} = \frac{3}{2} = \frac{1}{2} = \frac{2}{2} = \frac{2}{2} = \frac{1}{2} = 
                n++;
                                                                                                                                                                                                                                                                      i = 3 + 3 + 2 j = 1 + 2 + 2 n = 1 + 2 + 3
                                                                                                                                                                                                                                                                      i = 2
                                                                                                                                                                                                                                                                                                                                                                               i = 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          n = 3
```

#### What Does It Do?

- Describe in one short sentence what the snippet of code we just traced does.
- Don't repeat the code in English...