Functions & Recursion (1A)

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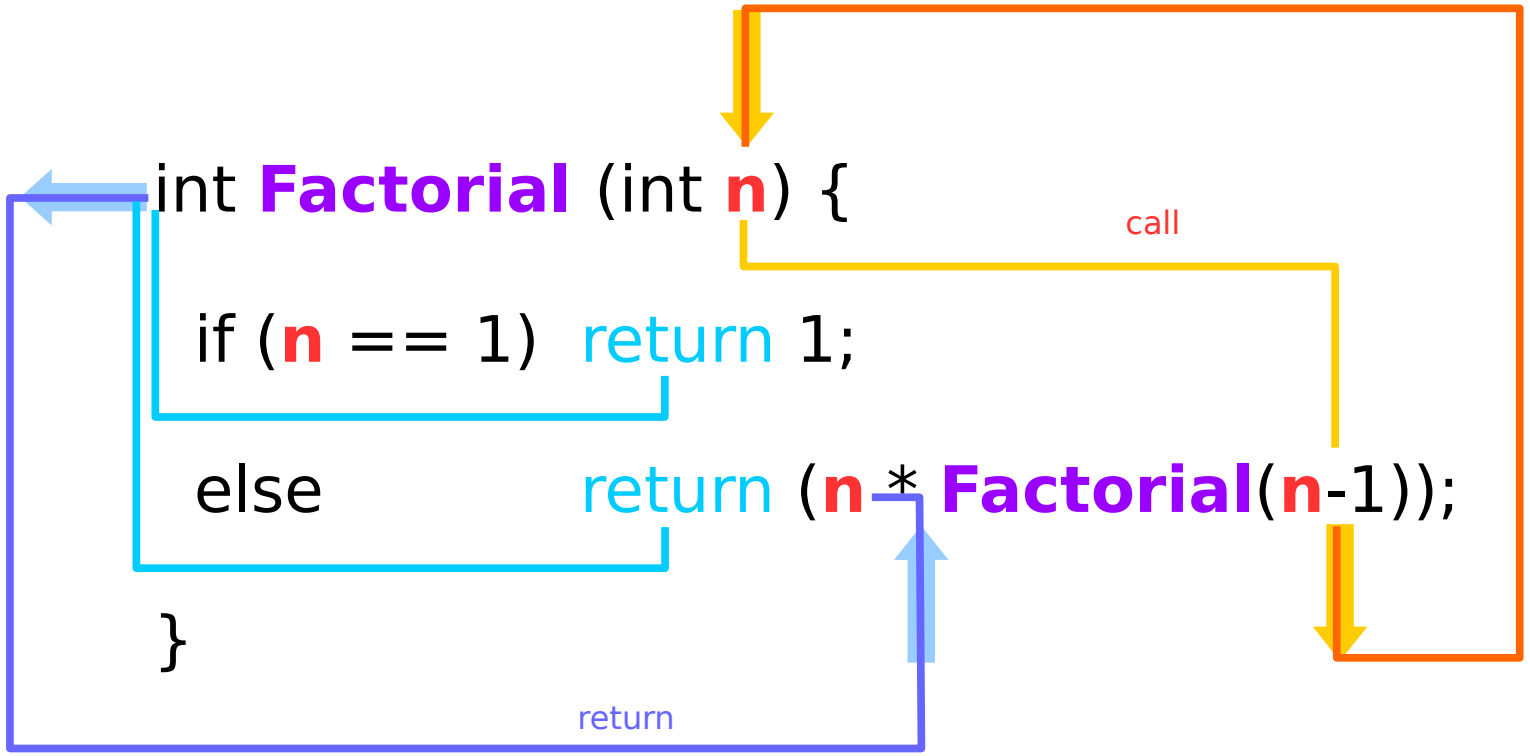
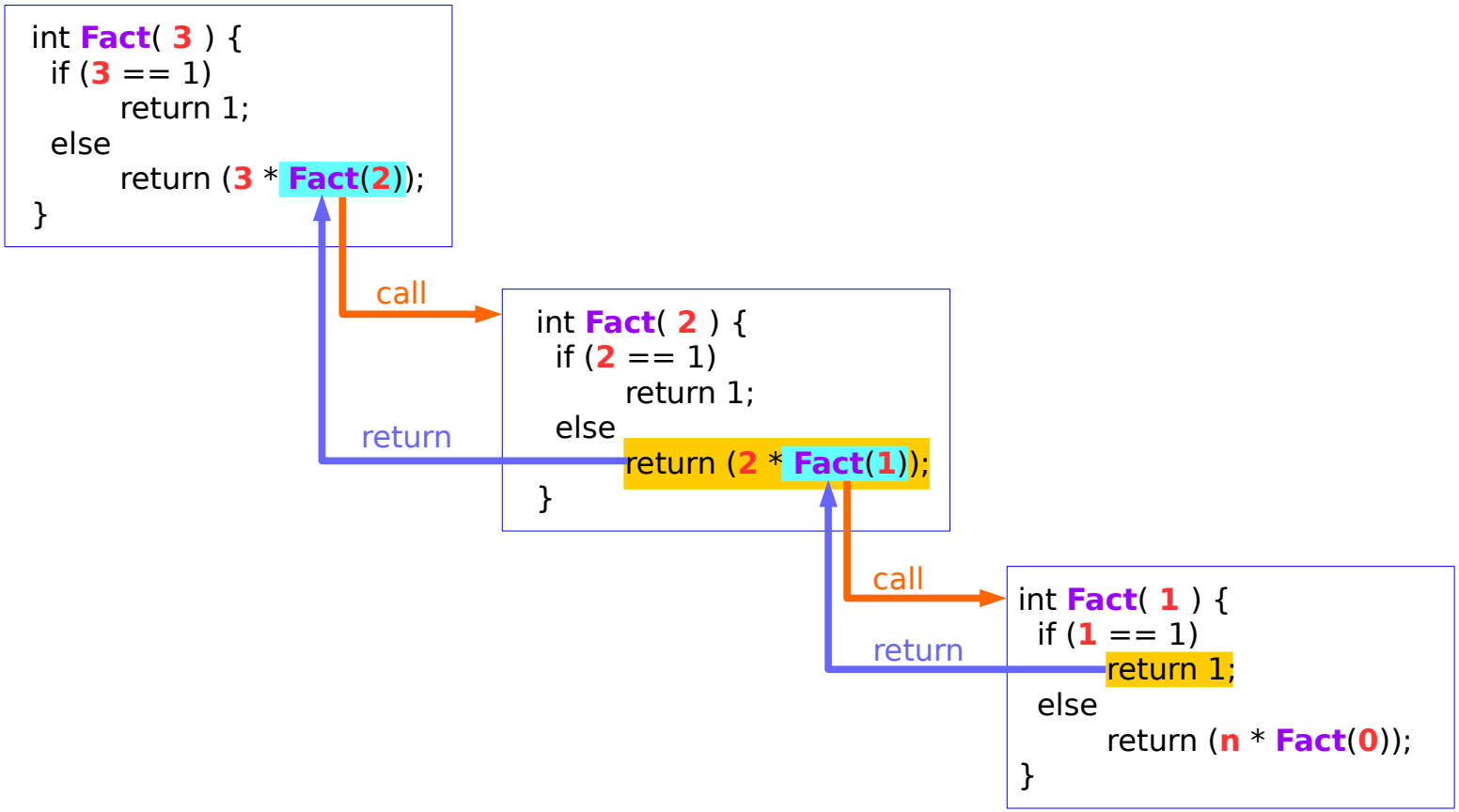
Iterative Factorial Function

```
int Factorial (int n) {
  int i, P=1;
  for (i=n; i>0; i--) P *= i;
  return (P);
}
```

Recursive Factorial Function

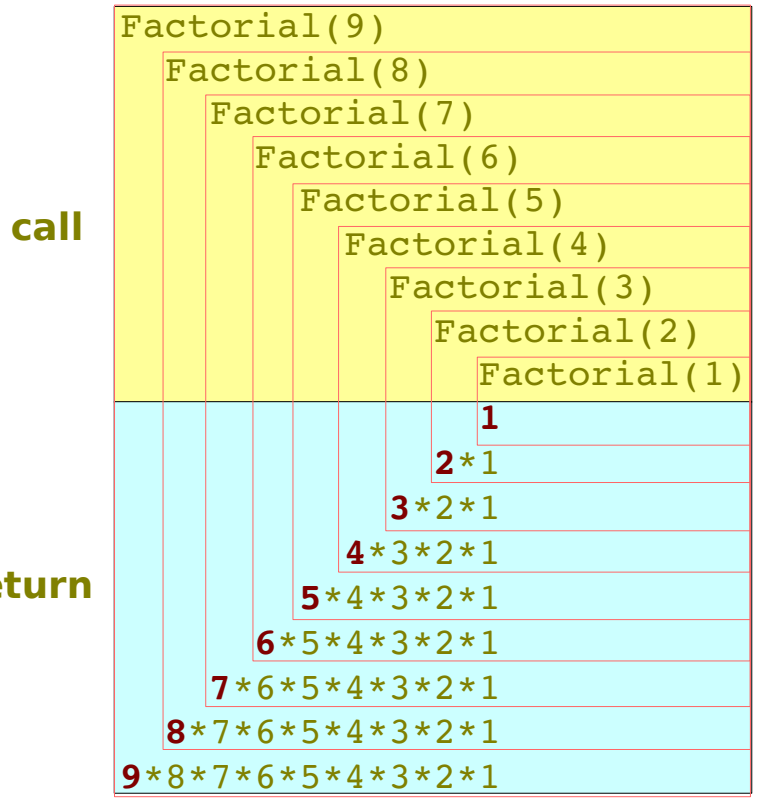


Unrolled Function Calls and Returns



Calling and Returning Sequence

```
#include <stdio.h>


int Factorial(int n) {
  if (n == 1)  return 1;
  else         return (n * Factorial(n-1));
}



int main(void) {
  int f = Factorial( 9 );

  printf("Factorial(9) = %d \n", f);

}
```



Verifying

```
#include <stdio.h>

int Factorial(int n) {
  int tmp;

  printf("n=%d ", n);
  if (n == 1) printf("Fact(1) = 1 \n");
  else printf("Fact(%d) = %d*Fact(%d)\n",n,n,n-1);

  if (n == 1) return 1;
  else {
    tmp = Factorial(n-1);
    printf("==> Fact(%d) = %d\n", n-1, tmp);
    return (n*tmp);
  }
}

int main(void) {

  Factorial( 9 );

}
```

```
n=9 Fact(9) = 9*Fact(8)
n=8 Fact(8) = 8*Fact(7)
n=7 Fact(7) = 7*Fact(6)
n=6 Fact(6) = 6*Fact(5)
n=5 Fact(5) = 5*Fact(4)
n=4 Fact(4) = 4*Fact(3)
n=3 Fact(3) = 3*Fact(2)
n=2 Fact(2) = 2*Fact(1)
n=1 Fact(1) = 1
==> Fact(1) = 1
==> Fact(2) = 2
==> Fact(3) = 6
==> Fact(4) = 24
==> Fact(5) = 120
==> Fact(6) = 720
==> Fact(7) = 5040
==> Fact(8) = 40320
==> Fact(9) = 362880
```

References

[1] Essential C, Nick Parlante
[2] Efficient C Programming, Mark A. Weiss
[3] C A Reference Manual, Samuel P. Harbison & Guy L. Steele Jr.
[4] C Language Express, I. K. Chun