

## Intermediate Division Short Problems

**1. Computer Number Systems**


Convert to octal:  $3A9B_{16}$

**2. Computer Number System:**

Evaluate and express the answer in hex:

$$32_8 + 1011_2 + 352_{10} + AF_{16}$$

**3. Recursive Functions**

Begin with a capital T consisting of 2 congruent segments.   
At the end of each segment place a segment half as long and perpendicular to it. Continue this process for an additional 5 times. How many segments are in the resulting figure?

**4. Recursive Functions**

Find  $f(12, 7)$  given:

$$f(x, y) = \begin{cases} f(x-1, y+2) + 3 & \text{if } x > y \\ 2 * f(x+1, y-1) - 5 & \text{if } x < y \\ x * x + y & \text{if } x = y \end{cases}$$

**5. What Does This Program Do?**

What is printed when this program is run?

```
a = 1: b = 2: c = 3: d = 4: e = 4: f = 6
if (d / b) < (f / a) then d = d / b
a = f ↑ b / c ↑ (d / b)
if (a <= f) && (b > e) then a = f else b = e
if abs(c - f) != int(f / c) then c = f / c else f = f / c
if (a == b) || (c == d) then a = a + b
c = c + d
output (b * c) * (f + d) / a / 2 * d - c + e ↑ (b - 2 * d)
```

**1. Computer Number Systems**

$$\begin{aligned}
 3A9B_{16} &= 0011\ 1010\ 1001\ 1011_2 \\
 &= 0\ 011\ 101\ 010\ 011\ 011_2 \quad \text{grouping by three} \\
 &= \quad 3 \quad 5 \quad 2 \quad 3 \quad 3_8
 \end{aligned}$$

**1.**  $35233_8$  or 35233**2. Computer Number Systems**

$$\begin{aligned}
 32_8 &= 26 \\
 1011_2 &= 11 \\
 352_{10} &= 352 \\
 AF_{16} &= 175 \\
 \text{So } 32_8 + 1011_2 + 352_{10} + AF_{16} \\
 &= 26 + 11 + 352 + 175 \\
 &= 564 \\
 \text{But } 564 &= 234_{16}
 \end{aligned}$$

**2.**  $234_{16}$  or 234**3. Recursive Functions**

The original T has 2 segments. The next step adds 3 more segments for a total of 5. The next step adds 6 segments for a total of 11. Next 12 segments are added for 23. The sequence formed is:

$$2, 5, 11, 23, 47, \dots, 3 \cdot 2^{n-1} - 1, \dots$$

The 7<sup>th</sup> term would be  $3 \cdot 2^6 - 1 = 191$

**3.** 191**4. Recursive Functions**

$$\begin{aligned}
 f(12,7) &= f(12-1,7+2)+3 = f(11,9)+3 = 522+3 = 525 \\
 f(11,9) &= f(11-1,9+2)+3 = f(10,11)+3 = 519+3 = 522 \\
 f(10,11) &= 2 * f(10+1,11-1)-5 = 2 * f(11,10)-5 = 2*262-5 = 519 \\
 f(11,10) &= f(11-1,10+2)+3 = f(10,12)+3 = 259+3 = 262 \\
 f(10,12) &= 2 * f(10+1,12-1)-5 = 2 * f(11,11)-5 = 2*132-5 = 259 \\
 f(11,11) &= 11*11+11= 132 \quad \text{Now substitute backwards.}
 \end{aligned}$$

**4.** 525

**5. What Does This Program Do?**

The following table contains the values of a, b, c, d, e, and f after each line:

a	b	c	d	e	f
1	2	3	4	4	6
1	2	3	2	4	6
12	2	3	2	4	6
12	4	3	2	4	6
12	4	2	2	4	6
16	4	2	2	4	6
16	4	4	2	4	6

$$\begin{aligned} & (b * c) * (f + d) / a / 2 * d - c + e \uparrow (b - 2 * d) \\ &= (4 * 4) * (6 + 2) / 16 / 2 * 4 - 4 + 4 \uparrow (4 - 2 * 2) \\ &= 16 * 8 / 16 / 2 * 4 - 4 + 4^0 \\ &= 128 / 16 / 2 * 2 - 4 + 1 = 8 / 2 * 2 - 4 + 1 = 5 \end{aligned}$$

**5. 5**