

# American Computer Science League

2023-2024 • Contest 1: Short Problems • Junior Division

## 1. Computer Number Systems

Convert  $2324_{10}$  to octal.

- A. 4442
- B. 4244
- C. 2444
- D. 4424
- E. 4224

## 2. Computer Number Systems

What is the value of  $73452_8 - 4261_8 + 752_8$  in base 16?

- A. 27771
- B. 70143
- C. 7063
- D. 70163
- E. 7043

## 3. Recursive Functions

Find  $f(22)$  given:

$$f(x) = \begin{cases} f(x-4) + 1 & \text{if } x \geq 12 \\ 2 \cdot f(x+1) - 3 & \text{if } 8 < x < 12 \\ x - 3 & \text{if } x \leq 8 \end{cases}$$

- A. 3
- B. 6
- C. 9
- D. 17
- E. 18

## 4. Recursive Functions

Find  $f(f(24))$  given:

$$f(x) = \begin{cases} f\left(\frac{x}{2}\right) + 4 & \text{if } x \text{ is even} \\ f(x-1) + 2 & \text{if } x \text{ is odd and prime} \\ x & \text{otherwise} \end{cases}$$

Remember that 1 is not a prime number.

- A. 21
- B. 19
- C. 15
- D. 11
- E. 9

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## 5. What Does This Program Do? (Branching)

In jobs that are paid an hourly wage, overtime is paid at 1.5 times the regular rate for any hours over 40. Which of the following correctly calculates this pay?

a. 

```
if hrs > 40 then
    pay = (hrs-40) * rate * 1.5 + hrs * rate
else
    pay = hrs * rate
end if
```

b. 

```
pay = hrs * rate
if hrs > 40 then
    pay = pay + (hrs-40) * rate * 0.5
end if
```

c. 

```
if hrs > 40 then
    pay = (hrs-40) * rate * 0.5 + hrs * rate
else
    pay = hrs * rate
end if
```

d. 

```
pay = 40 * rate
if hrs > 40 then
    pay = pay + 1.5 * (hrs - 40) * rate
end if
```

- A. a, b, c
- B. a, c, d
- C. b, c, d
- D. a, c
- E. b, c