AI Internship Entrance Examination

Position: AI intern

Duration: 45 minutes

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1. Let $\vec{u} = \begin{bmatrix} 1 \\ k \\ 3 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} -5 \\ -1 \\ 1 \end{bmatrix}$. The angle between $\vec{u}$ and $\vec{v}$ is $\frac{\pi}{2}$ radians.

   Find the value of k

   ....

   ....

   ....

2. Given matrix $A = \begin{bmatrix} 1 & b \\ 0 & 1 \end{bmatrix}$. Compute A^n

   ....

   ....

   ....

   ....

   ....

3. Given matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, **determinant** of A is $\det(A) = ad - bc$

   By changing rows of A, matrix B is obtained:

   $$B = \begin{bmatrix} c & d \\ a & b \end{bmatrix} \text{ and } \det(B) = b.c - a.d = -\det(A)$$

   Find matrix P such that: $PA = B$

   ....

   ....

   ....

   ....

   ....

4. Given 3 coins, flip them simultaneously, what is the probability that exactly 2 coins landing head?

   a. $\frac{2}{3}$

   b. $\frac{3}{8}$

   c. $\frac{1}{2}$

   d. $\frac{1}{4}$

5. A bag contains 3 red, 4 green, and 5 blue balls. Suppose that, you randomly draw 3 balls from the bag, what is the probability that all of them are blue?

   a. $\frac{1}{22}$

   b. $\frac{1}{11}$

   c. $\frac{3}{22}$

   d. $\frac{1}{4}$

6. In a class, there are 15 boys and 10 girls. Three students are selected at random. The probability that 1 girl and 2 boys are selected, is:

   a. $\frac{25}{117}$

   b. $\frac{21}{46}$

   c. $\frac{1}{50}$

   d. $\frac{3}{25}$

7. How many ways could 7 students be arranged in 3 chairs?

   a. 35

   b. 21

   c. 210

   d. 60

8. Simplify the following Boolean expression:

$$(A + B + C)(D + E') + (A + B + C)(D + E)$$

   a. $A + B + C$

   b. $D + E$

   c. $(A + B + C)D$

   d. None of the above

9. Last digit of 2^{2022} is:

   a. 8

   b. 2

   c. 6

   d. 4

10. How many permutations of the set $\{a, b, c, d, e\}$ do not have a in the first position?

    a. 24

    b. 96

    c. 120

    d. 60

11. What is the result the following code snippet?

```python
# input array
a = [1, 10, -20, 0, 5, 8, -10, 0, -101, 224]

# iterate over the array
i = 0
while i < len(a):
  if a[i] < 0:
    print(-a[i])
  elif a[i] > 0:
    # check if an element is even or not
    if a[i] % 2 == 0:
      print(a[i] // 2)
    else:
      print(a[i] * 2)

  i += 1
```

   a. `2 5 20 10 4 10 101 112`

   b. `2 5 20 0 10 4 10 0 101 112`

   c. `2 -10 20 10 16 10 101 448`

   d. `2 20 -10 10 -4 10 101 -112`

12. What is the result of the following code snippet?

```
a = [-100, -59, 1, 25, 34, 50, 60, 78, 100]
ans, lo, hi = -1, 0, len(a) - 1
while lo <= hi:
    md = (hi - lo) // 2 + lo
    if a[md] < 50:
        ans = md
        lo = md + 1
    else:
        hi = md - 1
print(a[ans])
```

   a. `50`

   b. `-100`

   c. `34`

   d. `60`

13. What is the result of the following code snippet?

```
def fun(x):
    if x <= 1: return 1
    return x * fun(x - 2)

print(fun(2) + fun(5))
```

   a. `124`

   b. `17`

   c. `7`

   d. `14`

14. What is the result of the following code snippet?

```
a = [-8, -6, -3, 0, 1, 4, 7]
i = 0
j = len(a) - 1
while i < j:
    # ** is exponential operator
    if a[i] ** 2 > a[j] ** 2:
        print(a[i])
        i += 1
    else:
        print(a[j])
        j -= 1
```

a. `0 1 -3 4 -6 7 -8`

b. `1 9 16 36 49 64`

c. `-8 7 -6 4 -3 1`

d. `-8 7 -6 4 -3 1 0`

15. What is the result of the following snippet?

```
a = [9, 1, -5, 2, -4, 3, -10]

i = 0
for j in range(len(a)):
    if a[j] < 0:
        a[j], a[i] = a[i], a[j] # swap values at i and j indices
        i += 1
print(a)
```
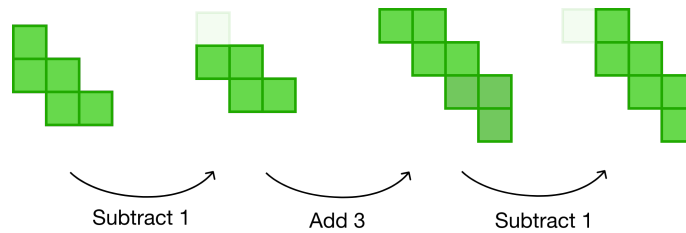
a. `9 1 2 3 -5 -4 -10`

b. `-5 -4 -10 2 1 3 9`

c. `-5 -4 -10 9 1 2 3`

d. `-5 -4 -10 3 2 1 9`

16. There are 4 scales with different values corresponding to the animal groups? Which is the value shown in the right-most scale?
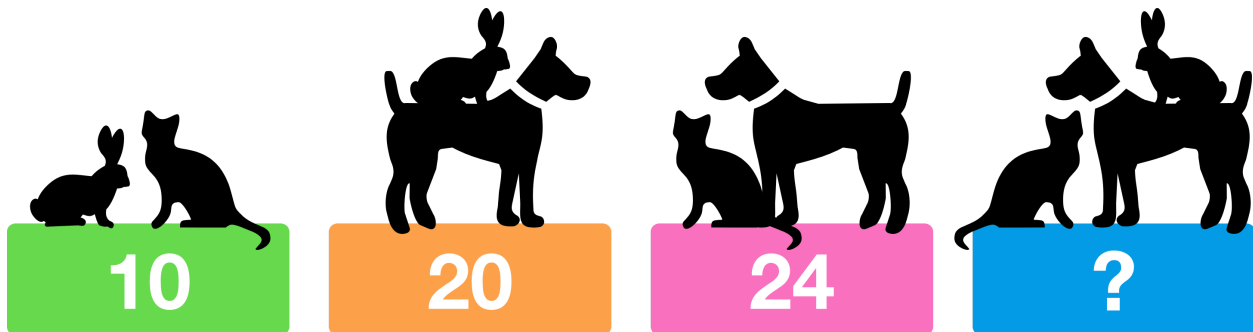
a. 25

b. 26

c. 27

d. 30

17. Starting at `0` squares, 2 operations can be applied in each step, illustrated in the below figure:

Subtract 1   Add 3   Subtract 1

These are the first 6 piles after the first 6 steps:

Step 1   Step 2   Step 3

Step 4   Step 5   Step 6
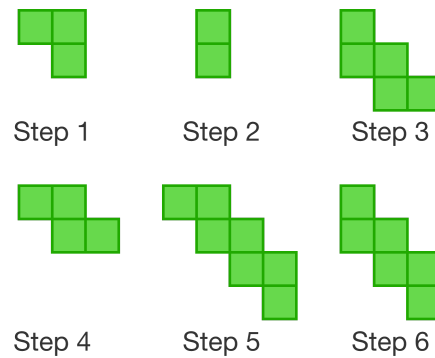
Note: there are 0 square at step `0` .How many squares are there at step `99` ?

    a. 97

    b. 99

    c. 100

    d. 101

18. Jill is arranging tables for a party that will be placed in one long row, end to end. Each side of each table can seat one person:
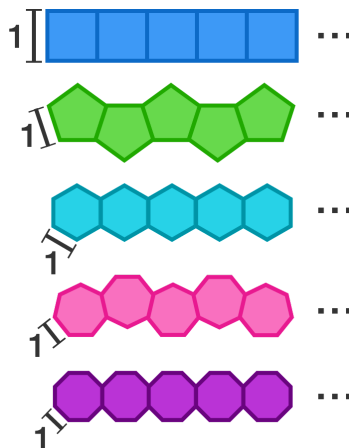
Which table shape **cannot** seat exactly 5050 people, regardless of the number of tables used?
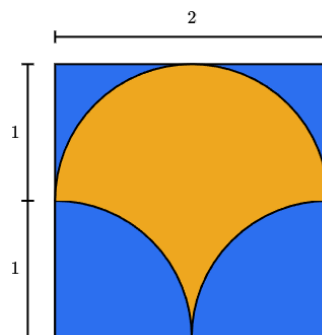
    a. Square (4)

    b. Pentagon (5)

    c. Hexagon (6)

    d. Heptagon (7)

19. For two of the three tetrominoes on the left, it's possible to use 4 copies of that tetromino (with rotation allowed) to tile a 4 by 4 square. One of the tetrominoes will **not** be able to tile the square. Which one?
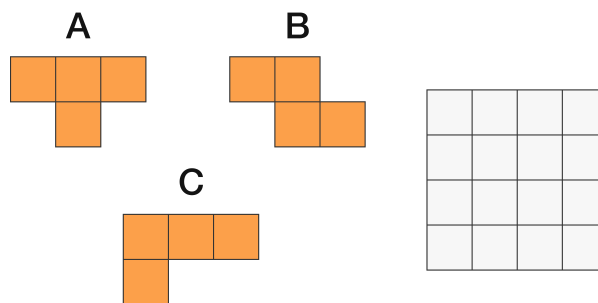
    a. A

    b. B

    c. C

20. What is the area of the yellow figure?

    a. $2 - \pi/2$

    b. $2 - \pi/4$

    c. 2

    d. $2 + \pi/2$