In [3]:
```
# Challenge 1 - Generating AR Tags

import numpy as np
import cv2

# LOAD CORRECT TAG DICTIONARY
arucoDict = cv2.aruco.getPredefinedDictionary(cv2.aruco.DICT_APRILTAG_16H
SIZE = 500 # pixels

IDs = [7, 18, 23]
# CREATE ARRAY FOR MARKER
for ID in IDs:
        marker = np.zeros((SIZE, SIZE, 1), dtype=np.uint8)

        # DRAW AND SAVE MARKER
        cv2.aruco.generateImageMarker(arucoDict, ID, SIZE, marker, 1)
        cv2.imwrite('two_tags_APRILTAG_16H5.png'.format(ID, SIZE), marker
```

In [4]:
```
# Challenge 2 - Calculating Distance Between Two AR Tags

import cv2
import numpy as np

tags = cv2.imread('data/two_tags_APRILTAG_16H5.png')

# Load the correct tag dictionary
arucoDict = cv2.aruco.getPredefinedDictionary(cv2.aruco.DICT_APRILTAG_16H

# Detect the markers
corners, ids, _ = cv2.aruco.detectMarkers(cv2.cvtColor(tags, cv2.COLOR_BG

# Draw detected markers
detection = cv2.aruco.drawDetectedMarkers(tags, corners, ids)

# Save the image with detected markers
cv2.imwrite('detection_two_tags_APRILTAG_16H5.png', detection)

# Assuming the corners are detected and ids are [0, 1] for the two tags
# Calculate the center points of each tag
if ids is not None:
    centers = []
    for corner in corners:
        center = np.mean(corner[0], axis=0)
        centers.append(center)

    # Calculate the distance between the two centers in pixels
    dist_pixels = np.linalg.norm(centers[0] - centers[1])

    # Convert distance to centimeters
    tag_width_cm = 3  # real-world width of each tag in cm
    tag_width_pixels = np.linalg.norm(corners[0][0][0] - corners[0][0][1]
    pixel_to_cm = tag_width_cm / tag_width_pixels
    dist_cm = dist_pixels * pixel_to_cm

    print(f"Distance between tags: {dist_cm} cm")
else:
    print("No tags detected.")
```

```
Distance between tags: 5.308489030818875 cm
```