Math 3 Assignment-2

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Task 1

Task 1

```
[2] def hammingDistance(n1, n2):
      x = n1 ^ n2
      setBits = 0
      while (x > 0):
        setBits += x & 1
        x >>= 1
      return setBits

    if __name__ == '__main__':
      n1 = 9
      n2 = 14
      print(hammingDistance(n1, n2))
```

```
3
```

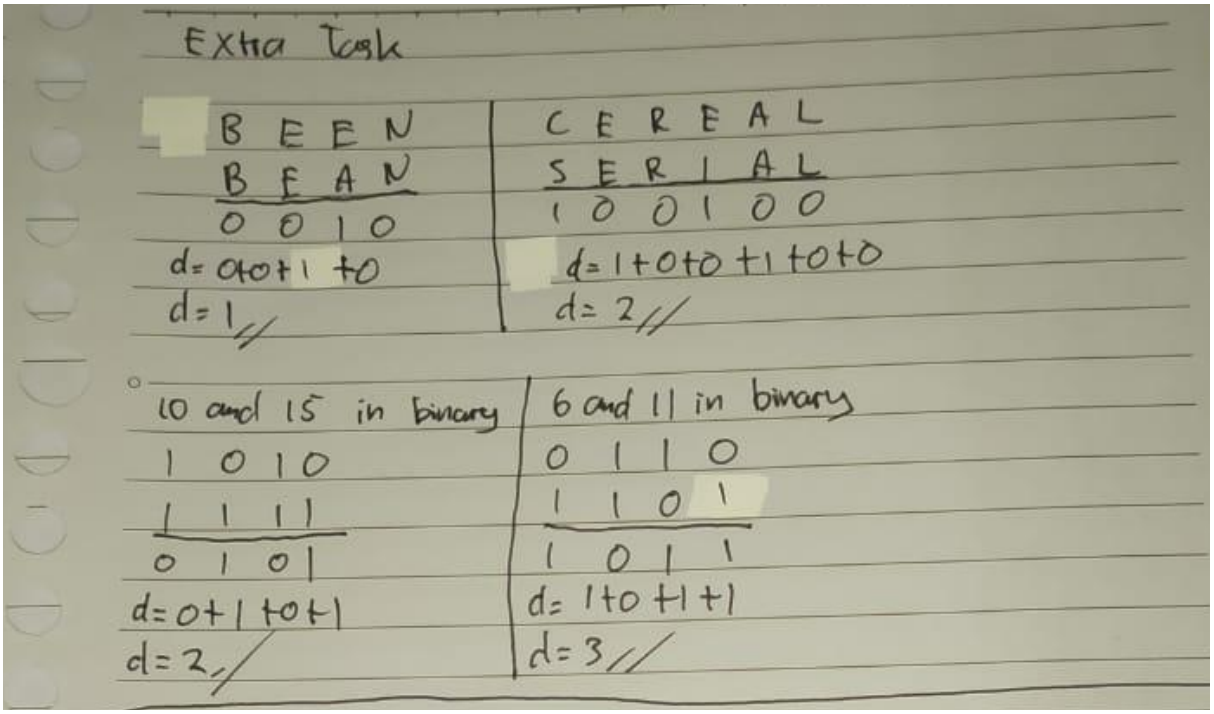
Task 2

Task 2

```
def hammingDistance(x, y):
    ans = 0
    m = max(x, y)
    while (m):
      c1 = x & 1
      c2 = y & 1
      if (c1 != c2):
        ans += 1
      m = m >> 1
      x = x >> 1
      y = y >> 1
    return ans

n1 = 4
n2 = 8
hdist = hammingDistance(n1, n2)
print(hdist)
```

```
2
```



Task 3

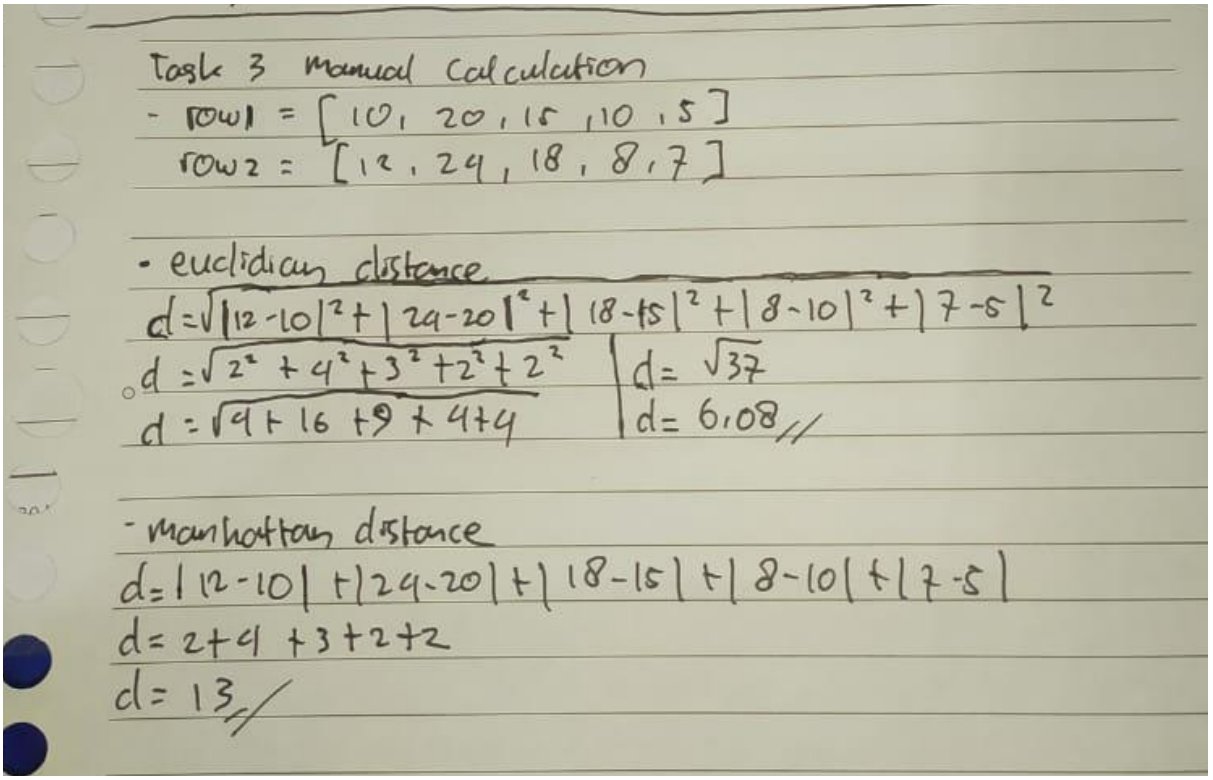
Task 3

```
from math import sqrt

def minowski_distance(a, b, p):
  return sum(abs(e1-e2) ** p for e1, e2 in zip(a, b)) ** (1/p)

row1 = [10, 20, 15, 10, 5]
row2 = [12, 24, 18, 8, 7]
dist = minowski_distance(row1, row2, 1)
print(dist)
dist = minowski_distance(row1, row2, 2)
print(dist)
```

```
13.0
6.082762530298219
```



Task 4

Minkowski Metric: Definition: The Minkowski metric, also known as the Minkowski distance or Lp distance, is a distance metric used to measure the dissimilarity between two points in a multi-dimensional space. It generalizes several other distance metrics, including the Euclidean distance and Manhattan distance.

Formula: The Minkowski distance between two points A and B in an n-dimensional space is calculated as follows:

$$D(A,B) = \left(\sum_{i=1}^{n} |A_i - B_i|^p\right)^{1/p}$$

Where:

- D(A,B)D(A,B) is the Minkowski distance between points A and B.

- AiAi and BiBi are the coordinates of points A and B in the i-th dimension.
- pp is a positive constant, determining the order of the metric. When p=1p=1, it's equivalent to the Manhattan distance, and when p=2p=2, it's equivalent to the Euclidean distance.

Example Case:

Recommendation Systems: In online retail, the Minkowski metric can be used to measure the similarity between users or products. By considering user behavior and preferences as multi-dimensional vectors, you can recommend products to users based on their similarity to other users who have shown interest in similar items.

Chebyshev Metric: Definition: The Chebyshev metric, also known as the maximum metric or L∞ distance, is a distance metric used to measure the maximum absolute difference between corresponding coordinates of two points in a multi-dimensional space.

Formula: The Chebyshev distance between two points A and B in an n-dimensional space is calculated as follows:

$$D(A, B) = \max_{i=1}^{n} |A_i - B_i|$$

Where:

- D(A,B)D(A,B) is the Chebyshev distance between points A and B.
- AiAi and BiBi are the coordinates of points A and B in the i-th dimension.

Example Case:

Network Routing: In computer networks, the Chebyshev metric is used to find the best path for data packets to travel from one node to another while minimizing the number of hops or maximizing available bandwidth.