1. a) Support threshold : 0.4 7 buckets

$\Rightarrow$ Support $= \lceil 0.4 \times 7 \rceil = \lceil 2.8 \rceil = 3$

$\Rightarrow$ Frequent items(s) : support ≥ 3

ID	Baskets
1	a,b,c,e
2	a,d,b
3	c,b
4	a,b,d,e
5	b,d
6	a,b
7	a

Pass 1

Counters in Memory

1. a. b. c. e — a:1 b:1 c:1 e:1
2. a. d. b — a:2 b:2 c:1 d:1 e:1
3. c. b — a:2 b:3 c:2 d:1 e:1
4. a. b. d. e — a:3 b:4 c:2 d:2 e:2
5. b. d — a:3 b:5 c:2 d:3 e:2
6. a. b — a:4 b:6 c:2 d:3 e:2
7. a — a:5 b:6 c:2 d:3 e:2

∴ Frequent items with cardinality 1 : {a}, {b}, {d}

ID	Baskets
1	a,b,c,e
2	a,d,b
3	c,b
4	a,b,d,e
5	b,d
6	a,b
7	a

Pass 2. Frequent items: a. b. d

Counter in Memory

1. a.b.c.e : ab:1
2. a. d. b : ab:2 ad:1 bd:1
3. c.b : None.
4. a.b.d.e : ab:3 ad:2 bd:2
5. b. d : ab:3 ad:2 bd:3
6. ab : ab:4 ad:2 bd:3
7. a : None

∴ Frequent items with cardinality 2 : {ab}, {b.d}

ID	Baskets
1	a,b,c,e
2	a,d,b
3	c,b
4	a,b,d,e
5	b,d
6	a,b
7	a

Pass 3. Frequent items: {a.b} . {b.d} (⇒ only {a.b.d} can be frequent)

1. a.b.c.e : None

2. a.d.b : abd : 1

3. cb : None

4. a.b.d.e : a.b.d : 1

5. b.d : None

6. a.b 、 7. a : None.

So Frequent items: Cardinality 1 : {a.} {b} {d}

Cardinality 2 : {a b} . {b.d}

1.b) Total Number of buckets: 7

Suppor {b} : 6. Suppor {b.d} : 3

∴ The Suppor of {b.d} = $\frac{3}{7}$

And The Confidence of {b.d} = $\frac{\text{Suppor of } \{b.d\}}{\text{Suppor of } \{b\}} = \frac{3}{6} = 0.5$

It's enough to answer with the answer in 1 a) because We {b} and {b.d} are all frequent items. and we have counters for both of them. So we can Calculate the Suppor and also Confidence.

1.c) threshold = 0.33 i.e Suppor of frequent items ≥ $\lceil 6 \times 0.33 \rceil = 2$

ID	Baskets
1	1,3,4
2	4, 5
3	2,7
4	1,6
5	2,7
6	3

Pass 1.	Counters for items	Counters for buckets
1) 1.3.4	1 : 1 3 : 1 4 : 1	B_1: 2 B_2: 1
2) 4, 5	1 : 1 2 : 1 4 : 2 5 : 1	B_0: 1 B_1: 2 B_2: 1
3) 2.7	1 : 1 2 : 1 3 : 1 4 : 2 5 : 1 7 : 1	B_0: 2 B_1: 2 B_2: 1
4) 1.6	1 : 2 2 : 1 3 : 1 4 : 2 5 : 1 6 : 1 7 : 1	B_0: 2 B_1: 3 B_2: 1
5) 2.7	1 : 2 2 : 2 3 : 1 4 : 2 5 : 1 6 : 1 7 : 2	B_0: 3 B_1: 3 B_2: 1

6) 3 1:2 2:2 3:2 4:2 5:1 6:1 7:2 B_0:3 B_1:3 B_2:1

Bucket 6 only has 1 item so no need to calculate Hash function to map to 2-cardinality candidate set.

Frequent items: {1} {2} {3} {4} {7}

ID	Baskets
1	1,3,4
2	4,5
3	2,7
4	1,6
5	2,7
6	3

Pass 2: Frequent items: 1. 2. 3. 4. 7

Counters for Buckets: B_0:3 B_1:3 B_2:1

$\Rightarrow$ B_0 and B_1 are frequent buckets B_2 is not

1. 1.3. 4 : $f_{C(1,3)} = f_{C(3,4)} = 1 \Rightarrow$ Counters: (1.3):1 (3.4):1

$f_{C(1,4)} = 2 \Rightarrow$ No frequent.

2. 4.5 : $f_{(4,5)} = 0 \Rightarrow$ Counters: (1.3):1 (3.4):1 (4.5):1

3. 2.7 : $f_{(2,7)} = 0 \Rightarrow$ Counters: (1.3):1 (3.4):1 (4.5):1 (2.7):1

4. 1.6 : $f_{(1,6)} = 1 \Rightarrow$ Counters: (1.3):1 (3.4):1 (4.5):1 (2.7):1

(1.6):1

5. 2.7 : $f_{(2,7)} = 0 \Rightarrow$ Counters: (1.3):1 (3.4):1 (4.5):1 (2.7):2

(1.6):1

C_0, Frequent items with cardinality 2: {2.7}

Frequent items: {1} {2} {3} {4} {7} {2.7}