|  |  |
| --- | --- |
| **1-ItemSet**  **(Frequent 1-itemSet)** | **Frequency** |
| Barley | 7 |
| Corn | 7 |
| Gram | 7 |
| Millet | 8 |
| Rice | 11 |
| Wheat | 10 |

Total transaction =12, minimum support level =33%, confidence=66%

**Table-2 :** 2-item Set

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **2-item Set** | **Frequency** | **2-item Set** | **Frequency** | **2-item Set** | **Frequency** |
| Barley, Corn | 4 | Corn, Millet | 5 | Millet, Rice | 7 |
| Barley, Gram | 5 | Corn, Rice | 6 | Millet, Wheat | 6 |
| Barley, Millet | 5 | Corn, Wheat | 6 | Rice, Wheat | 10 |
| Barley, Rice | 6 | Gram, Millet | 3 |  |  |
| Barley, Wheat | 5 | Gram, Rice | 6 |  |  |
| Corn, Gram | 4 | Gram, Wheat | 5 |  |  |

Since , (Gram, Millet) occurred 3 times out of 12 transaction. So this 2-item Set is not the part of frequent item as it is less than minimum support level (33%).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Frequent 2-item Set** | **Frequency** | **Frequent 2-item Set** | **Frequency** | **Frequent 2-item Set** | **Frequency** |
| Barley, Corn | 4 | Corn, Millet | 5 | Millet, Rice | 7 |
| Barley, Gram | 5 | Corn, Rice | 6 | Millet, Wheat | 6 |
| Barley, Millet | 5 | Corn, Wheat | 6 | Rice, Wheat | 10 |
| Barley, Rice | 6 |  |  |  |  |
| Barley, Wheat | 5 | Gram, Rice | 6 |  |  |
| Corn, Gram | 4 | Gram, Wheat | 5 |  |  |

**Table-3:** 3-itemSet **(**Barley, Corn, Gram, Millet, Rice, Wheat**)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **3-itemSet** | **Fre** | **3-itemSet** | | **Fre** | **3-itemSet** | **Fre** |
| Barley, Corn, Gram | 3 | Corn, Gram, Millet | | 2 | Millet, Rice, Wheat | 6 |
| Barley, Corn, Millet | 3 | Corn, Gram, Rice | | 3 | Barley, Millet, Wheat | 3 |
| Barley, Corn, Rice | 3 | Corn, Gram, Wheat | | 3 | Barley, Rice, Wheat | 5 |
| Barley, Corn, Wheat | 3 | Corn, Millet, Rice | | 4 |  |  |
| Barley, Gram, Millet | 3 | Corn, Millet, Wheat | | 4 |  |  |
| Barley, Gram, Rice | 4 | Corn, Rice, Wheat | | 6 |  |  |
| Barley, Gram, Wheat | 3 | Gram, Millet, Rice | | 2 |  |  |
| Barley, Millet, Rice | 4 | Gram, Rice, Wheat | | 5 |  |  |
| Frequent 3-itemSet | | | Frequency | | | |
| Barley, Gram, Rice | | | 4 | | | |
| Barley, Millet, Rice | | | 4 | | | |
| Corn, Millet, Rice | | | 4 | | | |
| Corn, Millet, Wheat | | | 4 | | | |
| Corn, Rice, Wheat | | | 6 | | | |
| Gram, Rice, Wheat | | | 5 | | | |
| Millet, Rice, Wheat | | | 6 | | | |
| Barley, Rice, Wheat | | | 5 | | | |

**Table-4: 4-itemset (**Barley, Corn, Gram, Millet, Rice, Wheat**)**

|  |  |  |  |
| --- | --- | --- | --- |
| 4 -itemSet | Fre | 4 -itemSet | Fre |
| Barley, Corn, Gram, Millet | 2 | Corn, Gram, Millet, Rice, | 1 |
| Barley, Corn, Rice, Wheat | 3 | Corn, Gram, Rice, Wheat | 3 |
| Barley, Corn, Millet, Rice | 2 | Corn, Millet, Rice, Wheat | 4 |
| Barley, Gram, Millet, Rice, | 2 | Gram, Millet, Rice, Wheat | 1 |
| Barley, Gram, Millet, Wheat | 1 |  |  |
| Barley, Gram, Rice, Wheat | 4 |  |  |
| Barley, Millet, Rice, Wheat | 3 |  |  |

|  |  |
| --- | --- |
| **Frequent 4 -itemSet** | **Fre** |
| Barley, Gram, Rice, Wheat | 4 |
| Corn, Millet, Rice, Wheat | 4 |

**Table-5: 5-itemset (**Barley, Corn, Gram, Millet, Rice, Wheat**)**

|  |  |  |
| --- | --- | --- |
| Barley, Corn, Gram, Millet, Rice, | 1 |  |
| Corn, Gram, Millet, Rice, Wheat | 1 |  |

No frequent item set for **5-itemset. So, I will set Association rule based Frequent 4-itemset**

Table-5 illustrates **5-itemset. But,** No frequent item set for **5-itemset. So, I will set Association rule based frequent 4-itemset of Table-4**

I = {Barley, Gram, Rice, Wheat} and {Corn, Millet, Rice, Wheat}

Non empty subset={Barley},{ Gram},{ Rice},{ Wheat} { Barley, Gram},{ Barley ,Rice},{ Barley , Wheat },

{ Gram, Rice },{ Gram , Wheat},{ Rice, Wheat },{ Barley, Gram, Rice},{ Barley, Rice, Wheat },{ Gram, Rice, Wheat }

Rule-1 : {Barley}🡪{ Gram, Rice, Wheat} , (s=33%,c= 57.14% )

Rule-2:{ Gram }🡪{Barley, Rice, Wheat}(s=33%, c= 57.14%)

Rule-3: { Rice }🡪{Barley, Gram, Wheat}(s=33%, c=36.36)

Rule-4: { Wheat }🡪{Barley, Gram, Rice}(s=33%, c= 40)

Rule-5: {Barley, Gram} 🡪{Rice, Wheat} (s=33%, c=80%)

Rule-6: { Barley ,Rice } 🡪{Gram, Wheat} (s=33%, c= 66.66 %)

Rule-6: { Barley , Wheat } 🡪{ Gram, Rice } (s=33%, c=80%)

Rule-7: { Gram, Rice } 🡪{ Barley , Wheat } (s=33%, c= 66.66 %)

Rule-8: { Gram , Wheat } 🡪{ Barley , Rice } (s=33%, c= 80%)

Rule-8: { Rice , Wheat } 🡪{ Barley, Gram } (s=33%, c= 40%)

Rule-9: { Barley, Gram, Rice } 🡪{ Wheat } (s=33%, c= 100%)

Rule-10: { Barley, Rice, Wheat } 🡪{ Gram } (s=33%, c= 80%)

Rule-11: { Gram, Rice, Wheat } 🡪{ Barley } (s=33%, c= 80%)

Based on problem, we can find out many Association rule from frequent item set, here I just calculated total 11 rules. Among of them, Red marked rule are invalid as their confidence <66%. On the other hand, Green marked rules are valid as confidence>=66%

Exam Problem-1

Frequent 1-itemset

|  |  |  |
| --- | --- | --- |
| 1-itemset | Frequency | Support percentage |
| Monitor | 8 | 8/10= 80% > 25% |
| Tablet | 9 | 9/10 =90% >25% |
| Printer | 7 | 7/10 = 70% >25% |
| headset | 6 | 6/10 =60% > 25% |

Frequent 2-itemset

|  |  |  |
| --- | --- | --- |
| 2-itemset | Frequency | Support percentage |
| Monitor, Tablet | 7 | 7/10=70% > 25% |
| Monitor, Printer | 5 | 5/10=50% > 25% |
| Monitor, headset | 5 | 5/10=50% > 25% |
| Tablet, Printer | 6 | 6/10=60% > 25% |
| Tablet, headset | 6 | 6/10=60% > 25% |
| Printer, headset | 4 | 4/10=40% > 25% |

Frequent 3-itemset

|  |  |  |
| --- | --- | --- |
| 3-itemset | Frequency | Support percentage |
| Monitor, Tablet, Printer | 4 | 4/10=40% > 25% |
| Monitor, Tablet, headset | 5 | 5/10=50% > 25% |
| Monitor, Printer, headset | 3 | 3/10=30% > 25% |
| Tablet, Printer, headset | 4 | 4/10=40% > 25% |

Frequent 4-itemset

|  |  |  |
| --- | --- | --- |
| 4-itemset | Frequency | Support percentage |
| Monitor, Tablet, Printer, headset | 3 | 3/10= 30% > 25% |
|  |  |  |

Exam Problem-2

1-itemset:

|  |  |  |
| --- | --- | --- |
| **Frequent 1-itemset** | **Frequency** | **Support** |
| Hairbrush | 5 | 5/10 = 50% >25% |
| Shampoo | 9 | 9/10 = 90% >25% |
| Hair conditioner | 6 | 6/10 =60 % >25% |
| Mirror | 5 | 5/10 =50% >25% |
| Hair dryer | 7 | 7/10 =70% >25% |

2-itemset:

|  |  |  |
| --- | --- | --- |
| **Frequent 2-itemset** | **Frequency** | **Support** |
| Hairbrush, Shampoo | 4 | 40% >25% |
| Hairbrush, Hair conditioner | 2 | 20<25% (not **Frequent 2-itemset**) |
| Hairbrush, Mirror | 2 | 20%<25%( **not Frequent 2-itemset**) |
| Hairbrush, Hair dryer | 3 | 30% >25% |
| Shampoo, Hair conditioner | 6 | 60% >25% |
| Shampoo, Mirror | 4 | 40% >25% |
| Shampoo, Hair dryer | 6 | 60% >25% |
| Hair conditioner, Mirror | 4 | 40% >25% |
| Hair conditioner, Hair dryer | 4 | 40% >25% |
| Mirror, Hair dryer | 3 | 30% >25% |

3-itemset: Hairbrush, Shampoo, Hair conditioner, Mirror, Hair dryer

|  |  |  |
| --- | --- | --- |
| **Frequent 3-itemset** | **Frequency** | **Support** |
| Hairbrush, Shampoo, Hair conditioner | 2 | 20%<25% |
| Hairbrush, Shampoo, Mirror | 1 | 10%<25% |
| Hairbrush, Shampoo, Hair dryer | 2 | 20%<25% |
| Hairbrush, Hair conditioner, Mirror | 1 | 10%<25% |
| Hairbrush, Hair conditioner, Hair dryer | 1 | 10%<25% |
| Hairbrush, Mirror, Hair dryer | 1 | 10%<25% |
| Shampoo, Hair conditioner, Mirror | 4 | 40%>25% |
| Shampoo, Hair conditioner, Hair dryer | 4 | 40%>25% |
| Shampoo, Mirror, Hair dryer | 2 | 20%<25% |
| Hair conditioner, Mirror, Hair dryer | 2 | 20%<25% |

Not possible to make 4-itemset.

***Frequent -1 itemset***

Hairbrush = (5 > 25%)

Shampoo =(9 > 25%)

Hair dryer=(7> 25%)

Hair Conditioner=(6 >25%)

Mirror=  (5  >25%)

------------------------------

**Frequent -2 itemset**

Hairbrush,Shampoo=(4 >25%)

Hairbrush, Hair dryer=(3 >25%)

Shampoo,Hair dryer=6>25%

Shampoo, Hair Conditioner=6>25%

Shampoo, Mirror=4>25%

Hair dryer , Hair Conditioner=4>25%

Hair dryer, Mirror = 3>25%

Hair Conditioner, Mirror=4>25%

--------------------------------------------------------

Note :  from 2 frequent item set  {**Hairbrush, Hair Conditioner=(2<25)} and {Hairbrush,Mirror=(2<25%)} is deleted**

***Frequent -3 itemset***

Shampoo,Hair dryer,Hair Conditioner=4>25%

Shampoo,Hair Conditioner,Mirror=4>25%

-------------------------------------------

Note : {Hairbrush,Shampoo,Hair dryer=2} , {Hairbrush,Shampoo,Hair Conditioner=2 } , {Hairbrush,Shampoo,Mirror=1},

{Hairbrush,Hair dryer,Hair Conditioner=1}, {Hairbrush,Hair dryer,Mirror=1}, {Hairbrush,Hair Conditioner,Mirror= 1},{Shampoo,Hair dryer,Mirror=2}

{Hair dryer,Hair Conditione,Mirror=2 } These Frequent 3 item set will be deleted as thet do not meet minimum support level

**Frequent -4 itemset**

Shampoo,Hair dryer, Hair Conditioner, Mirror =2 <25% which will be omited

***Confident level***

s->(i-s) ;

Here I={Shampoo,Hair dryer,Hair Conditioner}

Si={Shampoo}, {Hair dryer}, {Hair Conditioner},{Shampoo,Hair dryer}, {Shampoo,Hair Conditioner}, {Hair dryer,Hair Conditioner}

{Shampoo,Hair dryer}-->{Hair Conditioner}

support of I = occurrence of I/number of transaction = 4/10

c=support(i)/ support(s) = (4/10)/(6/10)=4/6=66.6>= minimum confident level