**Exercises:**

**2-a: 1-(1/2)^2-(1/2)^2 =0.5**

**2-b: 0**

**2-c: 1-(1/2)^2-(1/2)^2 =0.5**

**2-d:**

**1-(1/4)2-(3/4)2 = 0.375**

**1-(0/8)2-(8/8)2 = 0**

**1-(1/8)2-(7/8)2 = 0.218**

**4/20\*0.375+8/20\*0.218 = 0.16252**

**2-e:**

**1-(3/5)2-(2/5)2 = 0.48**

**1-(3/7)2-(4/7)2 = 0.4898**

**1-(2/4)2-(2/4)2 = 0.5**

**1-(2/4)2-(2/4)2 = 0.5**

**5/20\*0.48+7/20\*0.4898+4/20\*0.5+4/20\*0.5 = 0.4914**

**2-f: Car Type**

**2-g: Everyone is different and has no commonality with others**

**3-a：0.997**

**3-b:**

**a1= 0.997-0.732 = 0.256**

**a2 = 0.997-0.984 = 0.013**

**3-c:**

**Gain(1.0) = 0.997-0 =0.997**

**Gain(6.0) = 0.997-0 =0.997**

**Gain(5.0) = 0.997-0=0.997**

**Gain(4.0) = 0.997-0=0.997**

**Gain(7.0) = 0.997-0.222=0.775**

**Gain(3.0) =0.997-0=0.997**

**Gain(8.0) =0.997-0=0.997**

**3-d: a2**

**3-e:**

**a1=0.167=0.178=0.345**

**a2=0.267+0.222=0.489**

**so choose a1**

**5-a:**

**E=−0.4log2​0.4−0.6log2​0.6=0.9710**

**ΔA​=E−107​EA=T​−103​EA=F​ = 0.2813**

**ΔB​=E−104​EB=T​−106​EB=F​ = 0.2565**

**Therefore, the decision tree induction algorithm selects the A attribute**

**5-b:**

**GINI ​：G=1−(104​)2−(106​)2=0.48**

**GINIA=T​:1−(74​)2−(73​)2=0.4898**

**GINIA=F​：1−(30​)2−(33​)2=0**

**EA​=GINI ​−107​GINIA=T​−103​GINIA=F​=0.1371**

**GINIB=T​：1−(43​)2−(41​)2=0.3750**

**GINIB=F​：1−(61​)2−(65​)2=0.2778**

**EB​=GINI ​−104​GINIB=T​−106​GINIB=F​=0.1633**

**Therefore, the decision tree induction algorithm selects the B attribute**

**5-c:**

**Information gain examines the contribution of features to the entire data, not to specific categories, so generally it can only be used for global feature selection**

**The Gini coefficient is a feature selection method similar to the information entropy, which is used for the impurity of the data. When making feature selection, we can choose the one with the largest ΔGini(X).**