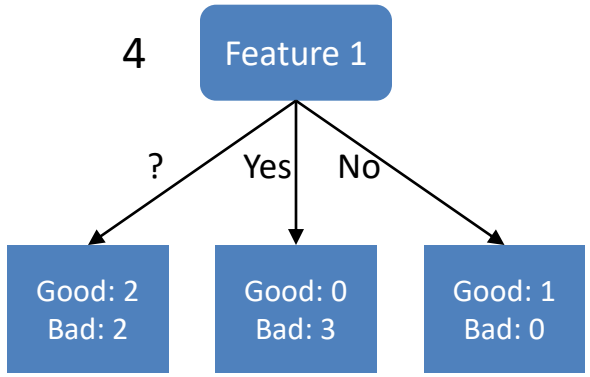
Decision Tree

Prof. Seungchul Lee

Industrial AI Lab.

Feature Test

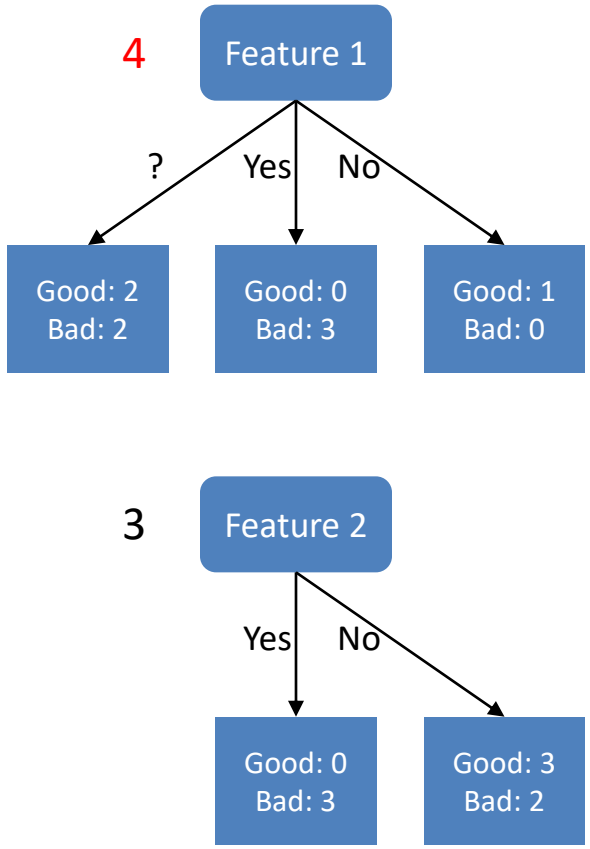
- Feature test in the first level



Feature 1	Feature 2	Feature 3	Feature 4	output
?	Yes	Low	Medium	Bad
Yes	Yes	High	Medium	Bad
?	No	High	Medium	Good
No	No	Medium	High	Good
?	No	Medium	Low	Good
Yes	No	Low	High	Bad
Yes	No	Medium	High	Bad
?	Yes	High	Low	Bad

Feature Test

- Homogeneous set in the first level



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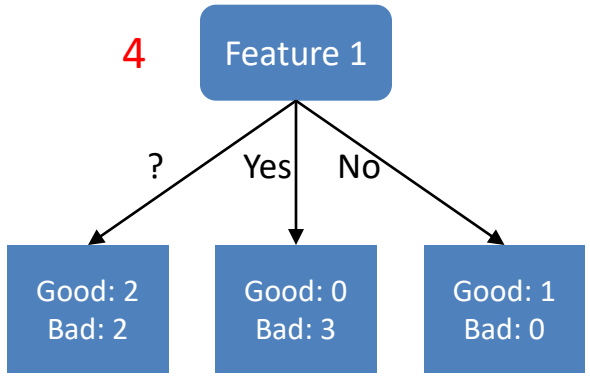

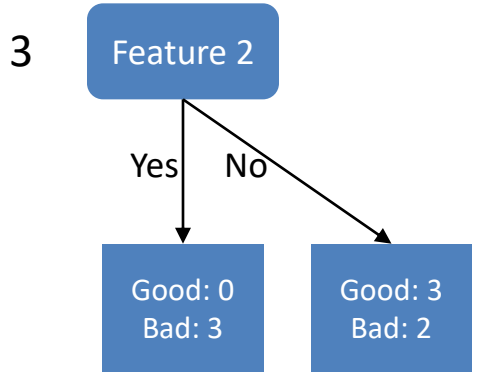

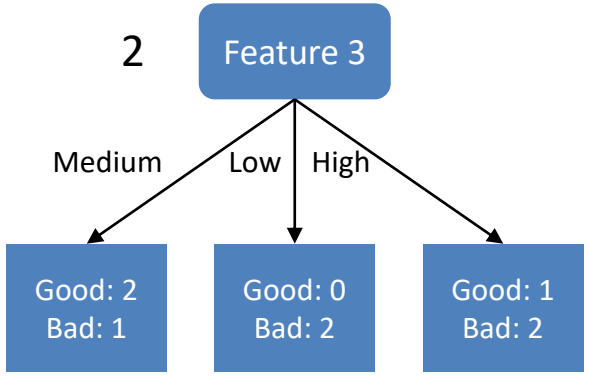

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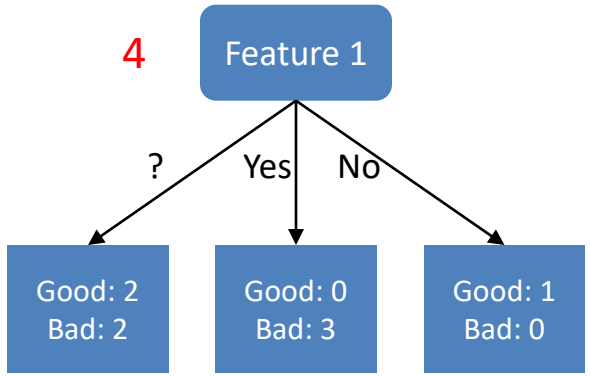
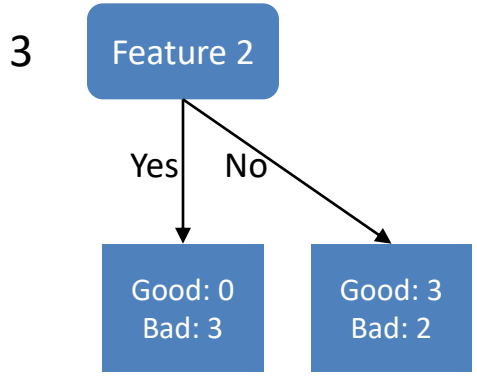
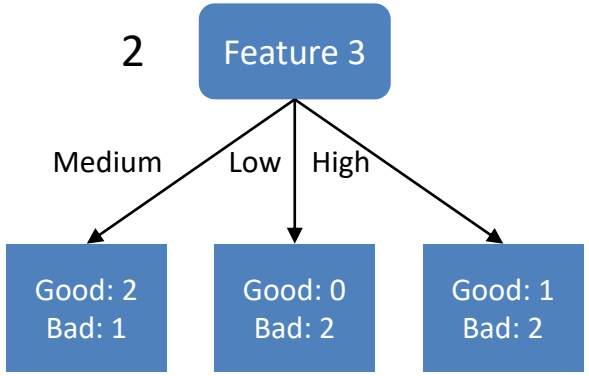
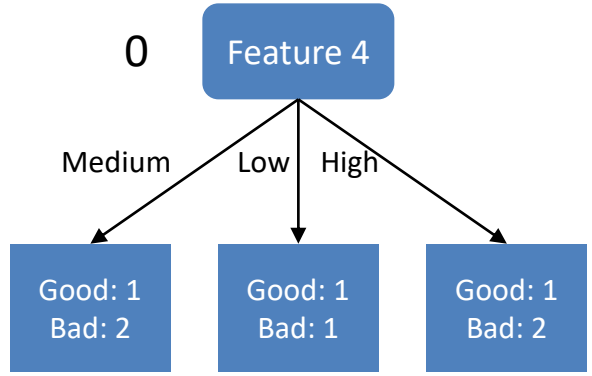


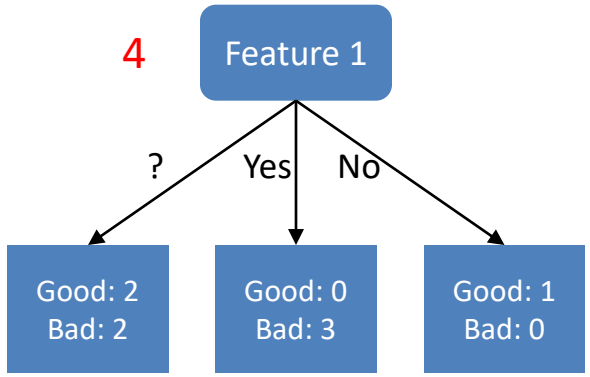






Feature Test

- Homogeneous set in the first level



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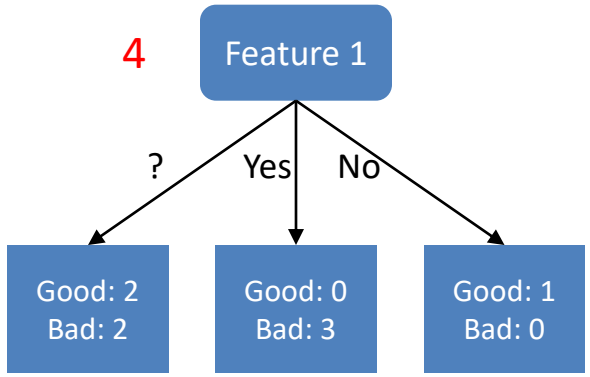
Feature Test

- Homogeneous set in the second level



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Yes	No	Low	High	Bad
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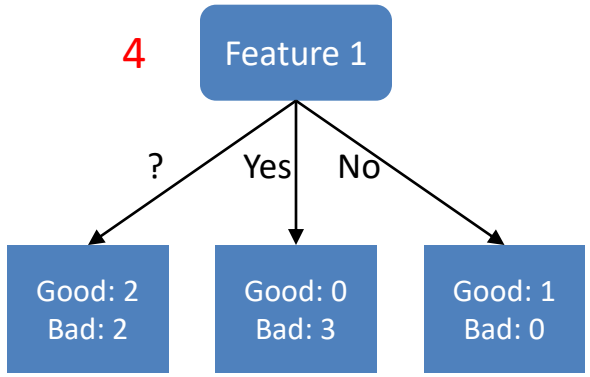
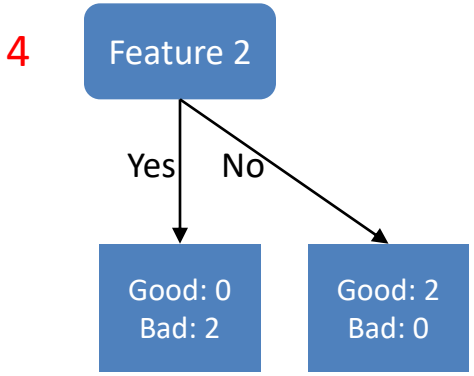
?	Yes	High	Low	Bad

Feature Test

- Homogeneous set in the second level





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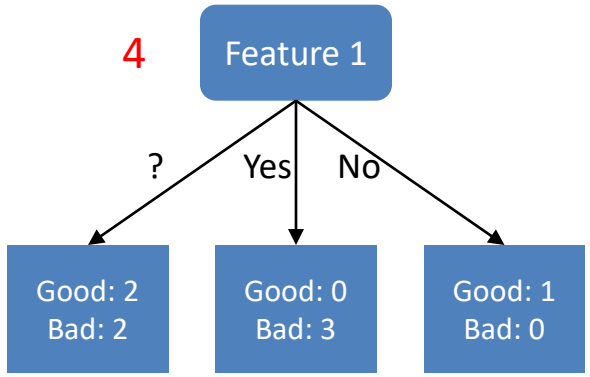

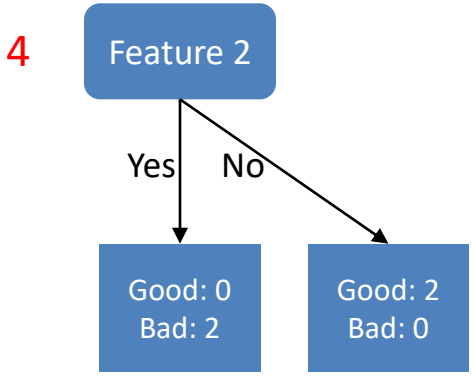

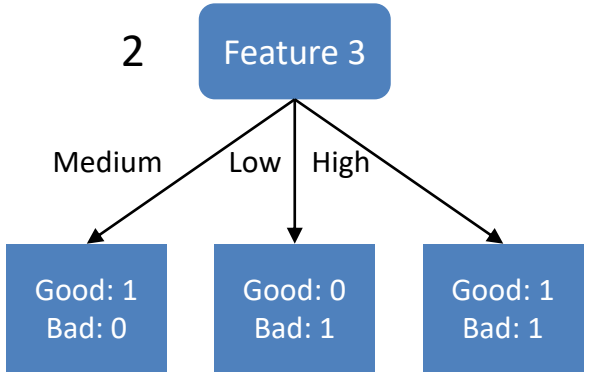

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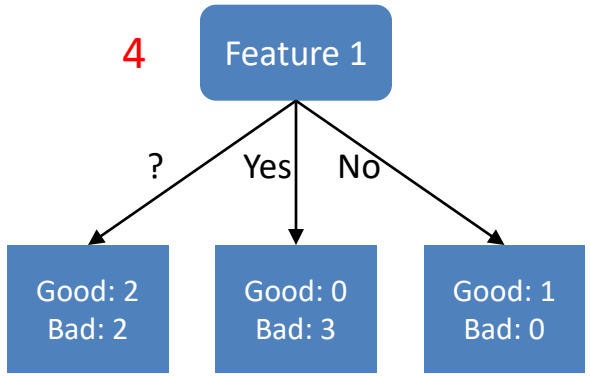
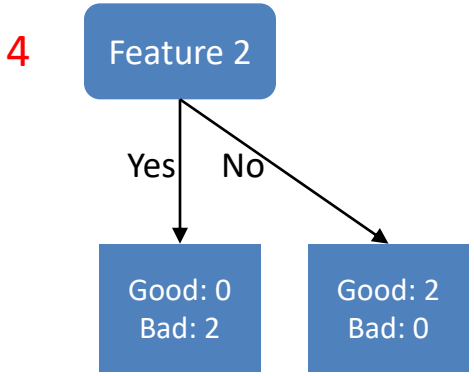
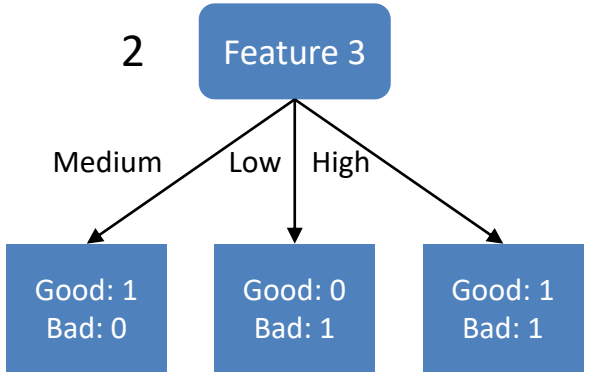
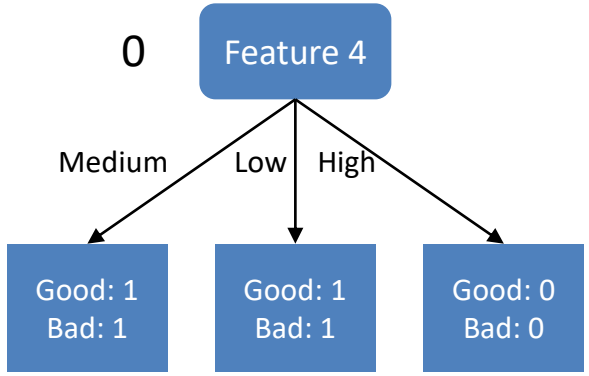


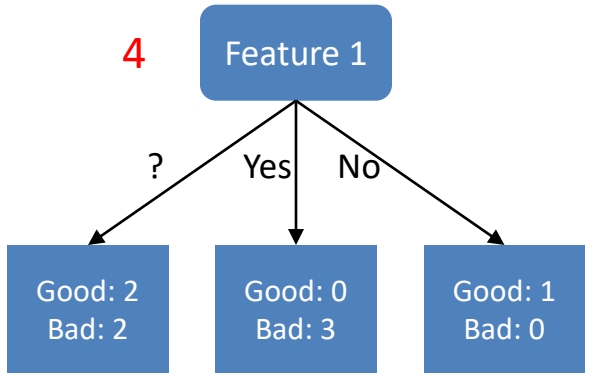


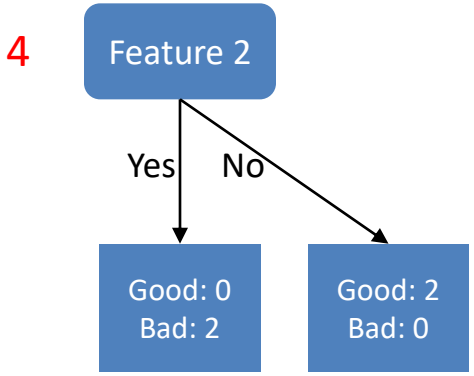




Feature Test

- Homogeneous set in the second level





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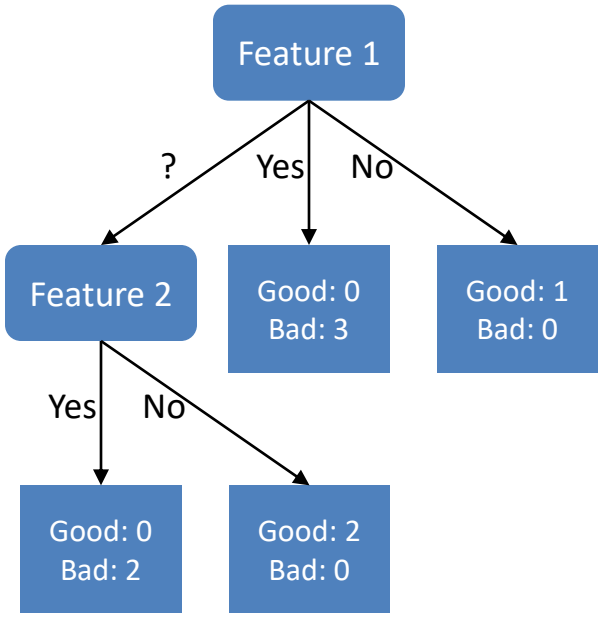
Feature Test

- Decision tree



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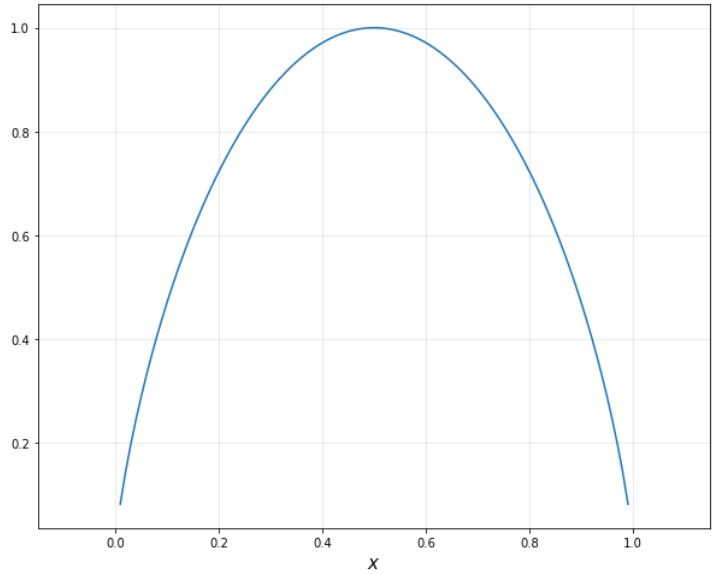
- Issue: a large data set will be most likely to produce zero homogeneous set

Disorder

- Disorder of single set

$$D = -x \log_2 x - (1-x) \log_2 (1-x)$$

$$D = -\frac{G}{T} \log_2 \frac{G}{T} - \frac{B}{T} \log_2 \frac{B}{T}$$

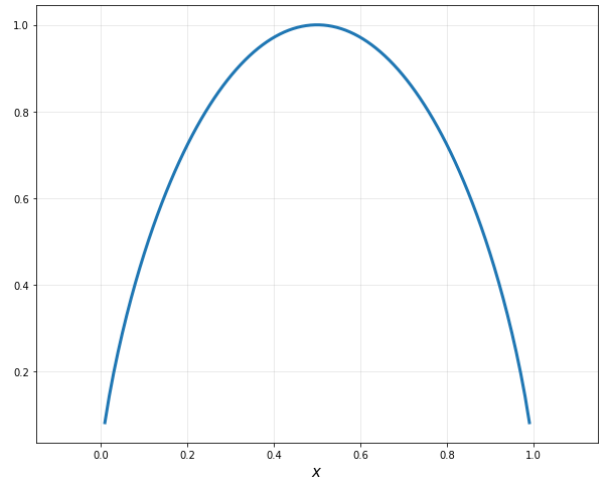


Quality of Test

- Disorder of single set

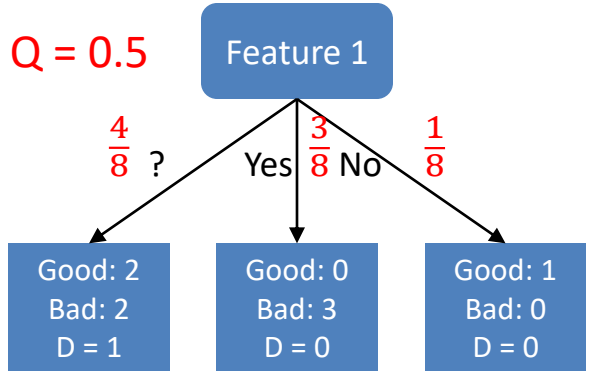
$$D = -x \log_2 x - (1-x) \log_2 (1-x)$$

$$D = -\frac{G}{T} \log_2 \frac{G}{T} - \frac{B}{T} \log_2 \frac{B}{T}$$



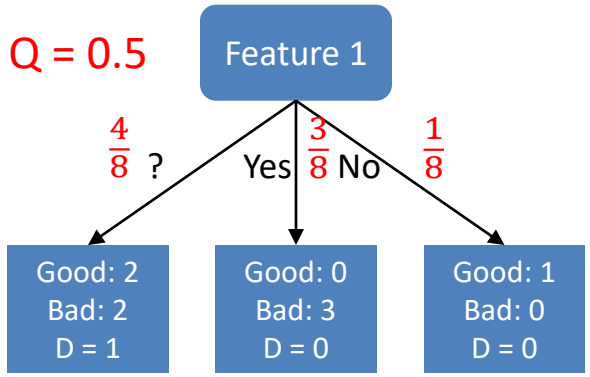
- Quality of test

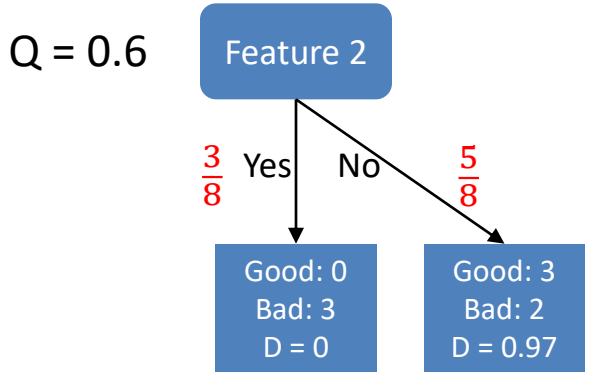
$$Q(\text{test}) = \sum D(\text{set}) \times \frac{\#\text{ of samples in set}}{\#\text{ of samples in all sets}}$$



Quality

- Quality of test in the first level





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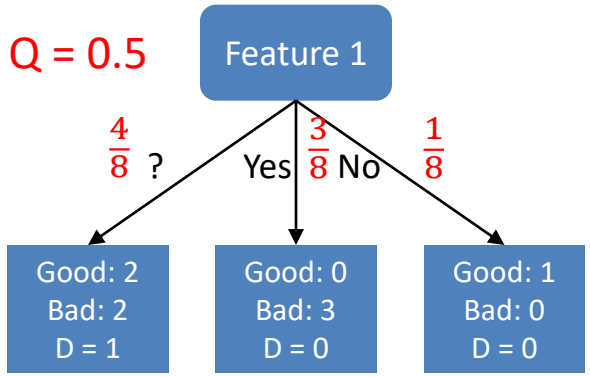

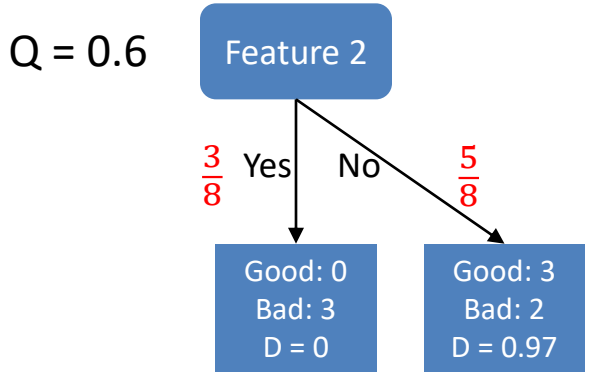

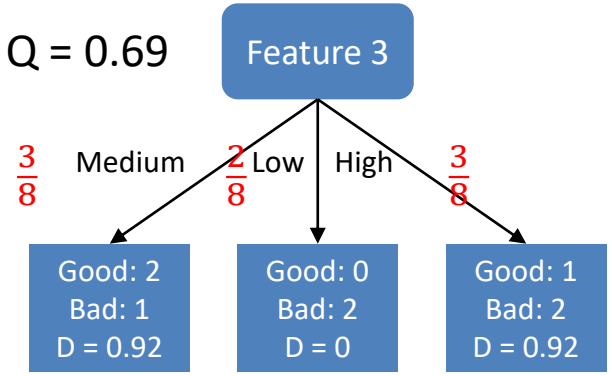

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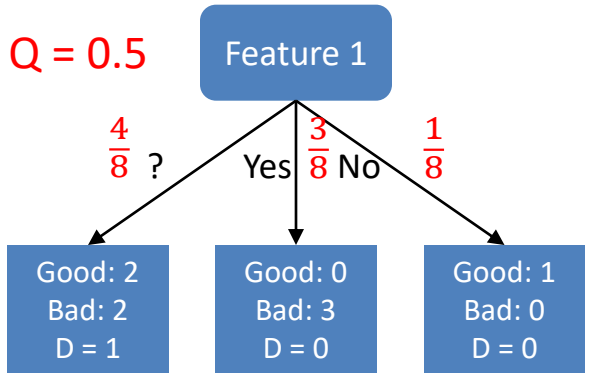

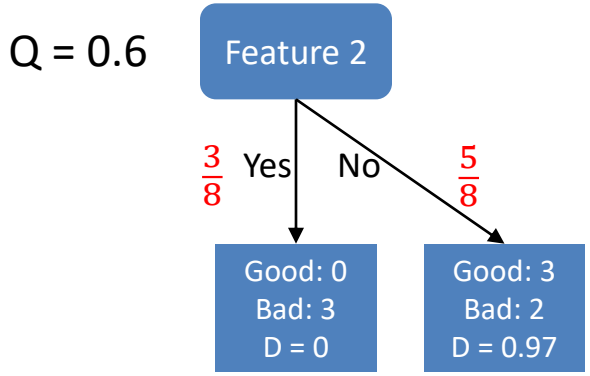

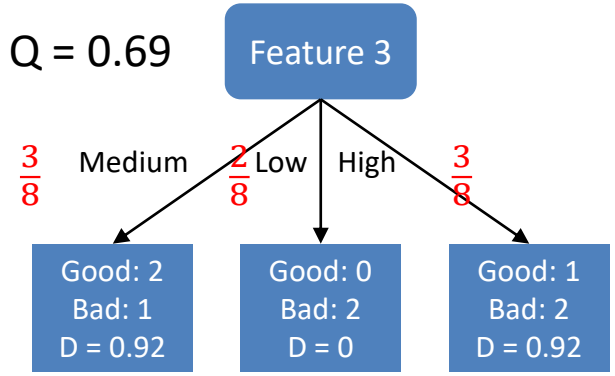

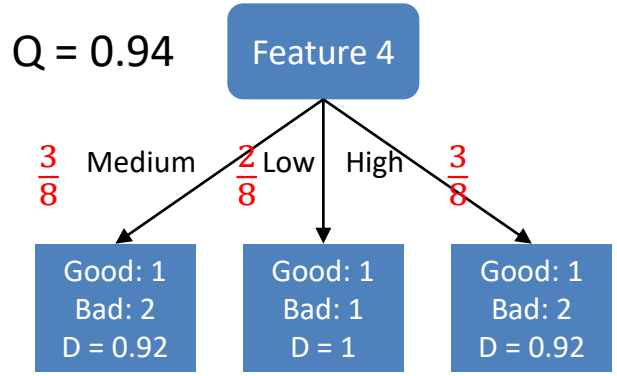

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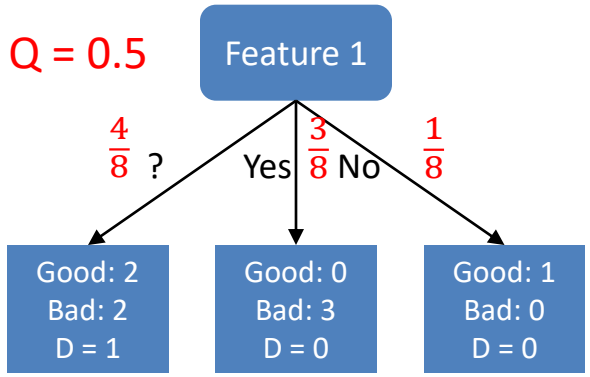

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Quality

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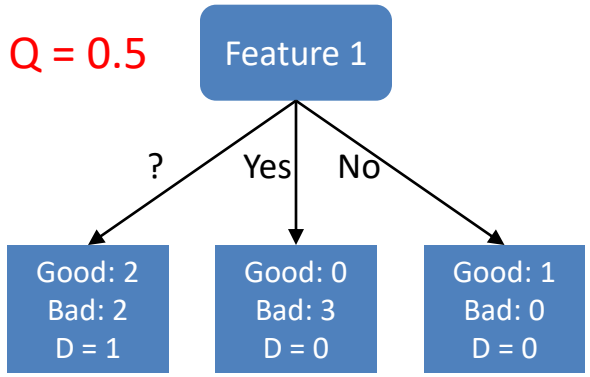

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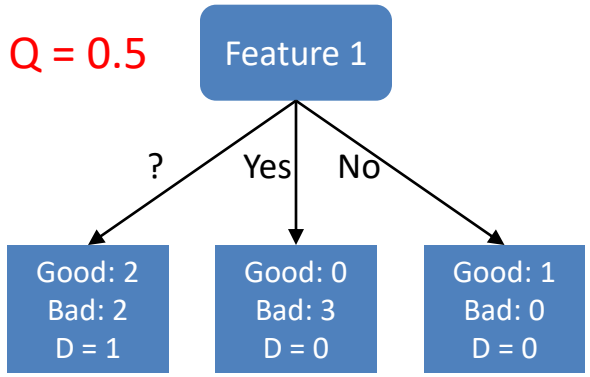

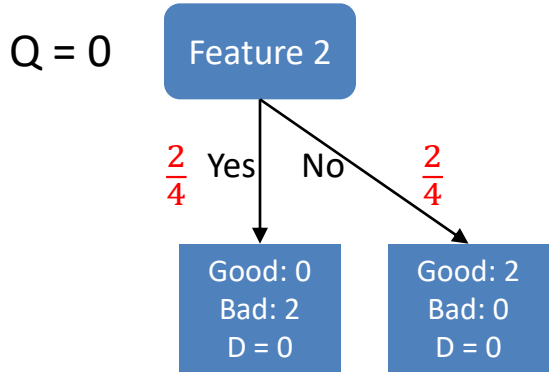

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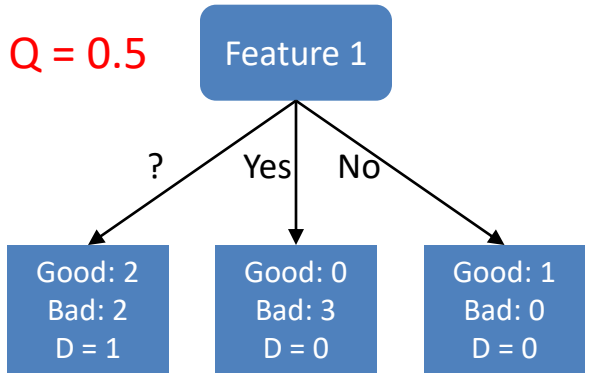
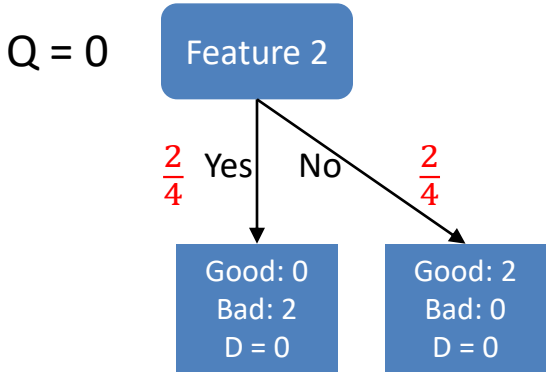
?	Yes	Low	Medium	Bad
Yes	Yes	High	Medium	Bad
?	No	High	Medium	Good
No	No	Medium	High	Good
?	No	Medium	Low	Good
Yes	No	Low	High	Bad
Yes	No	Medium	High	Bad
?	Yes	High	Low	Bad

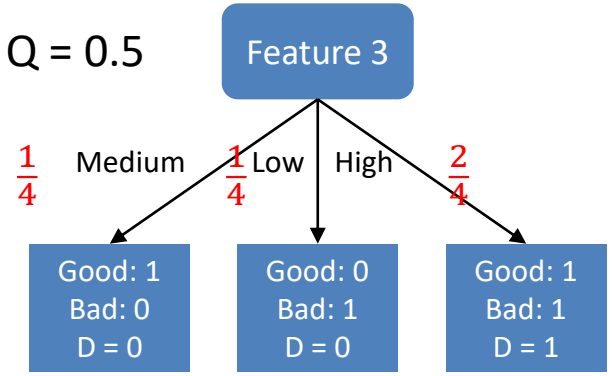
Quality

- Quality of test in the second level

Feature 1	Feature 2	Feature 3	Feature 4	output
?	Yes	Low	Medium	Bad
Yes	Yes	High	Medium	Bad
?	No	High	Medium	Good
No	No	Medium	High	Good
?	No	Medium	Low	Good
Yes	No	Low	High	Bad
Yes	No	Medium	High	Bad
?	Yes	High	Low	Bad



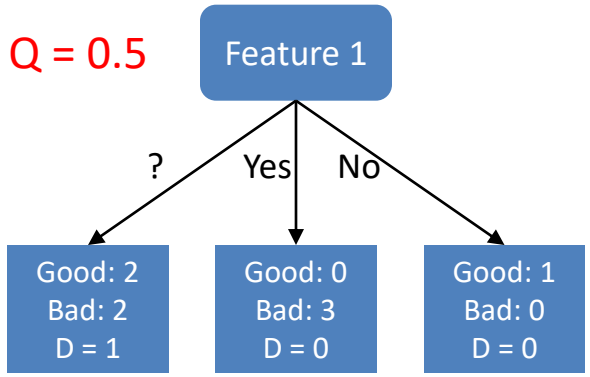


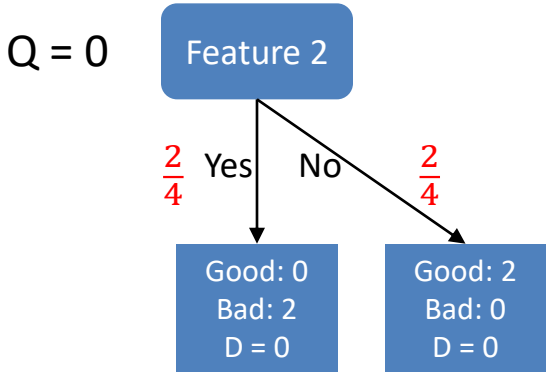


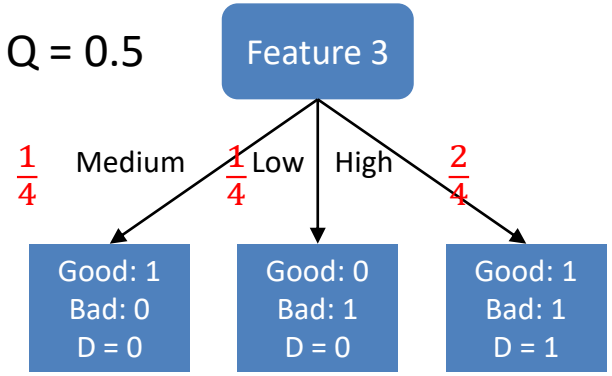
Quality

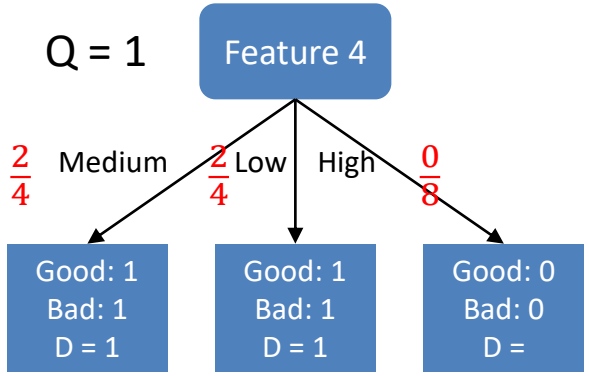
- Quality of test in the second level

Feature 1	Feature 2	Feature 3	Feature 4	output
?	Yes	Low	Medium	Bad
Yes	Yes	High	Medium	Bad
?	No	High	Medium	Good
No	No	Medium	High	Good
?	No	Medium	Low	Good
Yes	No	Low	High	Bad
Yes	No	Medium	High	Bad
?	Yes	High	Low	Bad



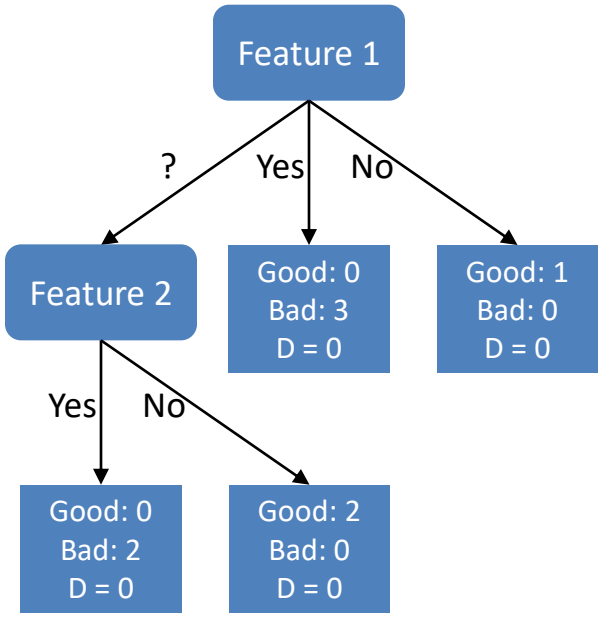






Quality

- Quality of test in the second level



Feature 1	Feature 2	Feature 3	Feature 4	output
?	Yes	Low	Medium	Bad
Yes	Yes	High	Medium	Bad
?	No	High	Medium	Good
No	No	Medium	High	Good
?	No	Medium	Low	Good
Yes	No	Low	High	Bad
Yes	No	Medium	High	Bad
?	Yes	High	Low	Bad