پاسخ سوال ۴

$x_{normal} = \frac{x - min}{max - min}$

$\frac{30-22}{66-22} = 0.25$

$\frac{55-22}{66-22} = 0.75$

Age: عددی — نرمال

Marital: Categorical بدون ترتیب — فاصله همینگ

Income: عددی — نرمال

Record	Age		Marital	Income		Risk
1	22	$\boxed{0}$	Single	$46,156.98	0.88	Bad loss
2	33	0.25	Married	$24,188.10	0.01	Bad loss
3	28	0.14	Other	$28,787.34	0.19	Bad loss
4	51	0.66	Other	$23,886.72	$\boxed{0}$	Bad loss
5	25	0.07	Single	$47,281.44	0.92	Bad loss
6	39	0.39	Single	$33,994.90	0.40	Good risk
7	54	0.73	Single	$28,716.50	0.19	Good risk
8	55	0.75	Married	$49,186.75	$\boxed{1}$	Good risk
9	50	0.64	Married	$46,726.50	0.9	Good risk
10	66	$\boxed{1}$	Married	$36,120.34	0.48	Good risk

min = 22
max = 66

min = 23886.72
max = 49186.75

$\frac{24188.10 - 23886.72}{49186.75 - 23886.72} = 0.01$

$\vdots$

$X = (30, Single, \$30000)$

$\underset{Age}{min} < 30 < \underset{Age}{max} \xrightarrow{Normalize} \frac{30-22}{66-22} = 0.18$

$\underset{income}{min} < 30000 < \underset{income}{max} \xrightarrow{Normalize} \frac{30000 - 23886.72}{49186.75 - 23886.72}$

$d(x,1) = \sqrt{(0.18-0)^2 + 0^2 + (0.24-0.88)^2} = \sqrt{0.442} = \boxed{0.66} \rightarrow NN3 \xrightarrow{Class} Bad\ ***$

$d(x,2) = \sqrt{(0.18-0.25)^2 + 1^2 + (0.24-0.01)^2} = \sqrt{1.0578} = 1.03$

$d(x,3) = \sqrt{(0.18-0.14)^2 + 1^2 + (0.24-0.19)^2} = \sqrt{1.0041} = 1.0$

$d(x,4) = \sqrt{1.288} = 1.13$

$d(x,5) = \sqrt{0.4745} = 0.69$

$d(x,6) = \sqrt{0.0697} = \boxed{0.26} \rightarrow NN1 \xrightarrow{Class} Good\ *$

$d(x,7) = \sqrt{0.305} = \boxed{0.55} \rightarrow NN2 \xrightarrow{Class} Good\ **$

$d(x,8) = \sqrt{1.9025} = 1.38$

$d(x,9) = \sqrt{1.6472} = 1.28$

$d(x,10) = \sqrt{1.75} = 1.31$

باتوجه به اینکه در اکثر همسایگی ها کلاس G
می باشد لذا کلاس متناظر X ← Good Risk
است :)

Record	Age	Marital	Income	Risk
1	22		$46,156.98	Bad loss
2	33		$24,188.10	Bad loss
3	28		$28,787.34	Bad loss
4	51		$23,886.72	Bad loss
5	25		$47,281.44	Bad loss
6	39		$33,994.90	Good risk
7	54		$28,716.50	Good risk
8	55		$49,186.75	Good risk
9	50		$46,726.50	Good risk
10	66		$36,120.34	Good risk

$X = (24, 25000)$

برای هر ویژگی هر کلاس باید میانگین و واریانس را محاسبه کنیم.

```
Mean Age_B = 31.8
Mean Age_G = 52.8
Var Age_B = 105.3599
Var Age_G = 75.75999
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Mean Income_B = 34060.116
Mean Income_G = 38948.99
Var Income_B = 109978875.95414403
Var Income_G = 60509902.353616
```

$$P(X_{Age}|B) = \frac{1}{\sqrt{2\pi}\,\sigma_{Age,B}} \exp\left\{-\frac{(X_{Age} - \mu_{Age,B})^2}{2\sigma^2_{Age,B}}\right\}$$

$$P(X_{income}|B) = \frac{1}{\sqrt{2\pi}\,\sigma_{income,B}} \exp\left\{-\frac{(X_{income} - \mu_{income,B})^2}{2\sigma^2_{income,B}}\right\}$$

$$P(X,B) = P(X_{Age}|B)\,P(X_{income}|B)$$

به علت اینکه احتمالات اولیه
یکسان است، برای مقایسه
دو کلاس نیاز به نوشتن آن نداریم!

```
P(X_Age | B) = 0.02911...
P(X_Income | B) = 2.6192...
P(X_Age | G) = 0.0001922...
P(X_Income | B) = 1.02740...
P(X | B) = 7.6271...
P(X | G) = 1.9749...
```

$\} P(X|G) < P(X|B) \Rightarrow$ X به کلاس BadRisk تعلق دارد.