Building Fuzzy Expert Systems

- T.-P. Hung and C.-Y. Lee
  "Induction of fuzzy rules and membership functions from training examples", Fuzzy Sets and Systems, 84 (1996), 33-47.

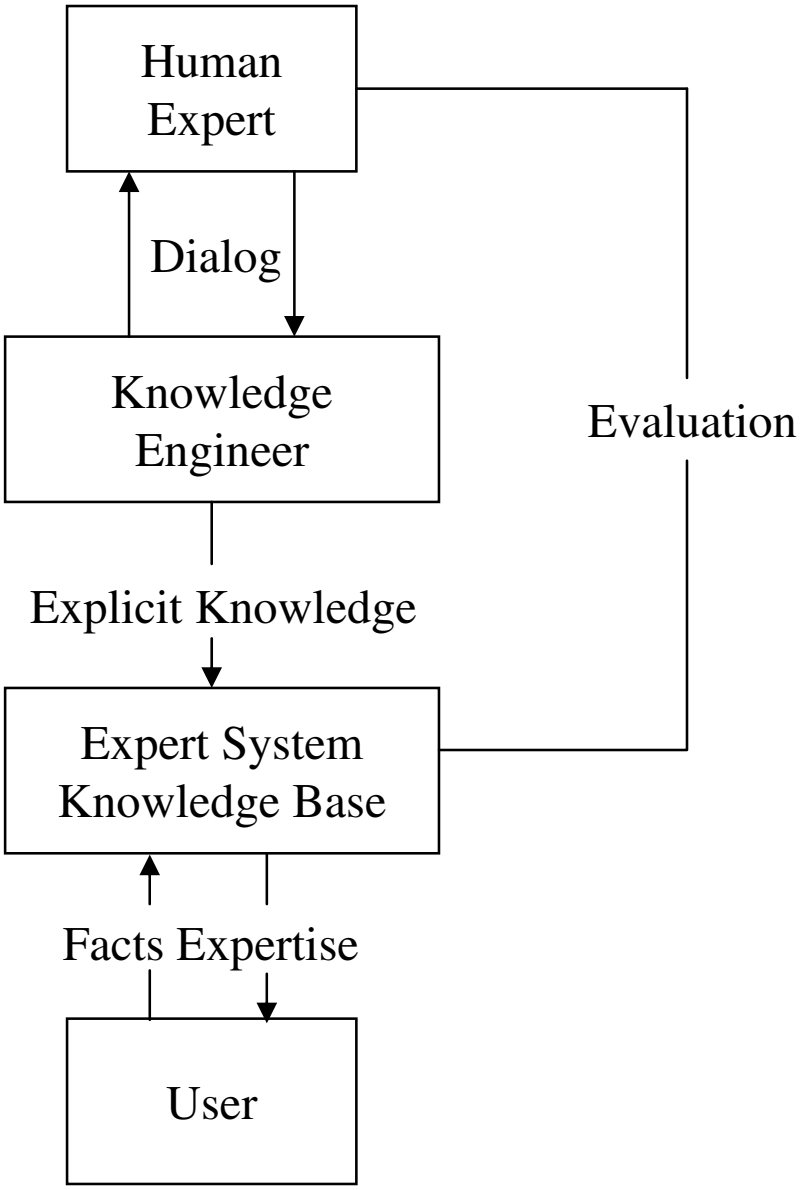

Fig. 1. Development of a classical expert system.

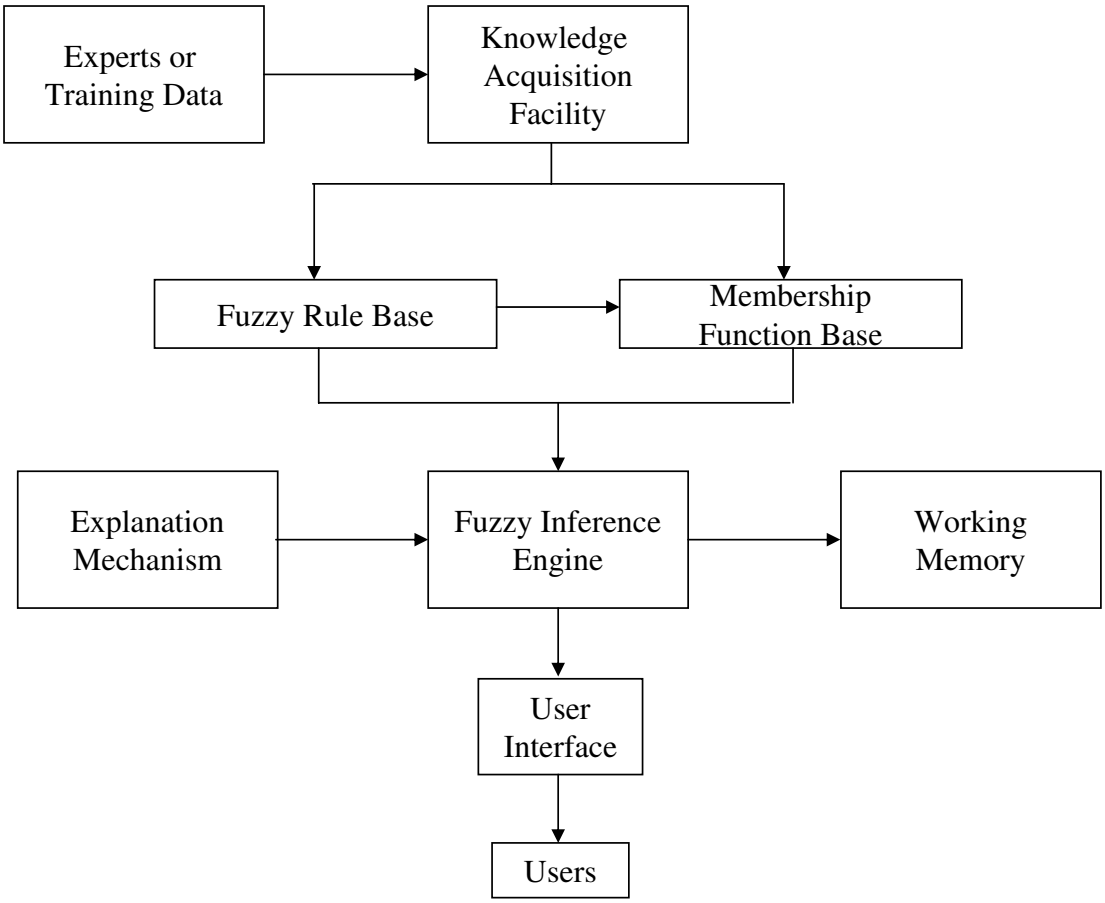

Fig. 2. Architecture of a fuzzy expert system.

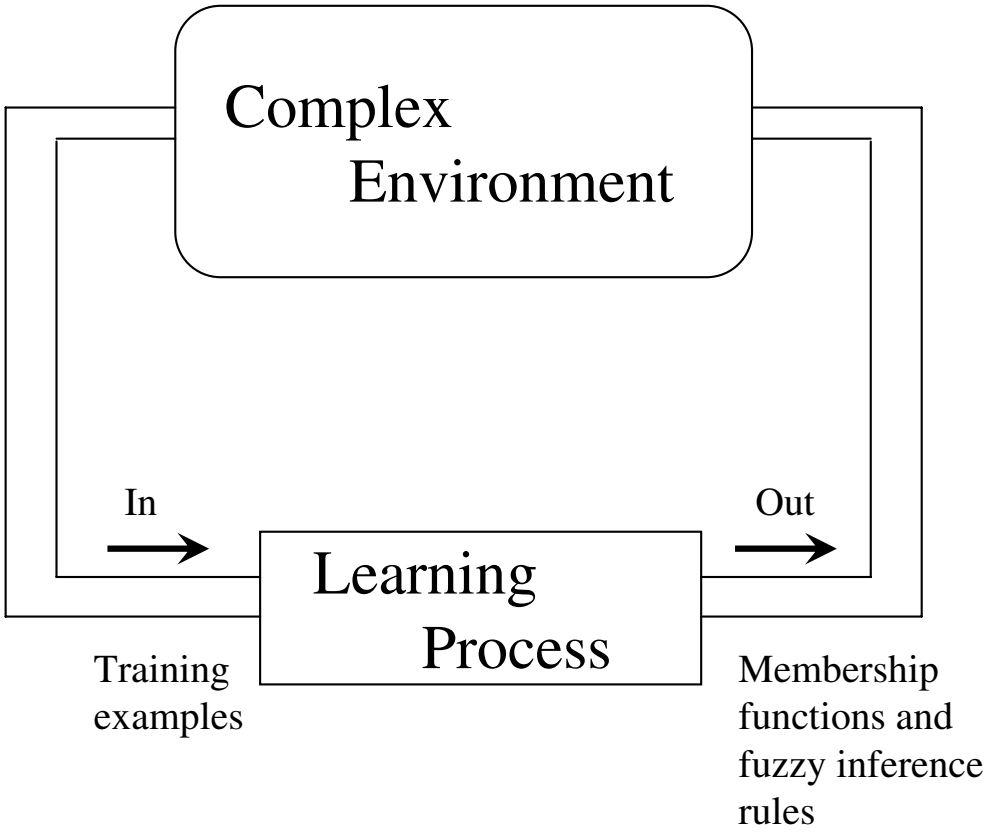

Fig. 3. Learning activity.

Age	*Property*	*Insurance fee*
(20,	30;	2000)
(25,	30;	2100)
(30,	10;	2200)
(45,	50;	2500)
(50,	30;	2600)
(60,	10;	2700)
(80,	30;	3200)
(80,	40;	3300)

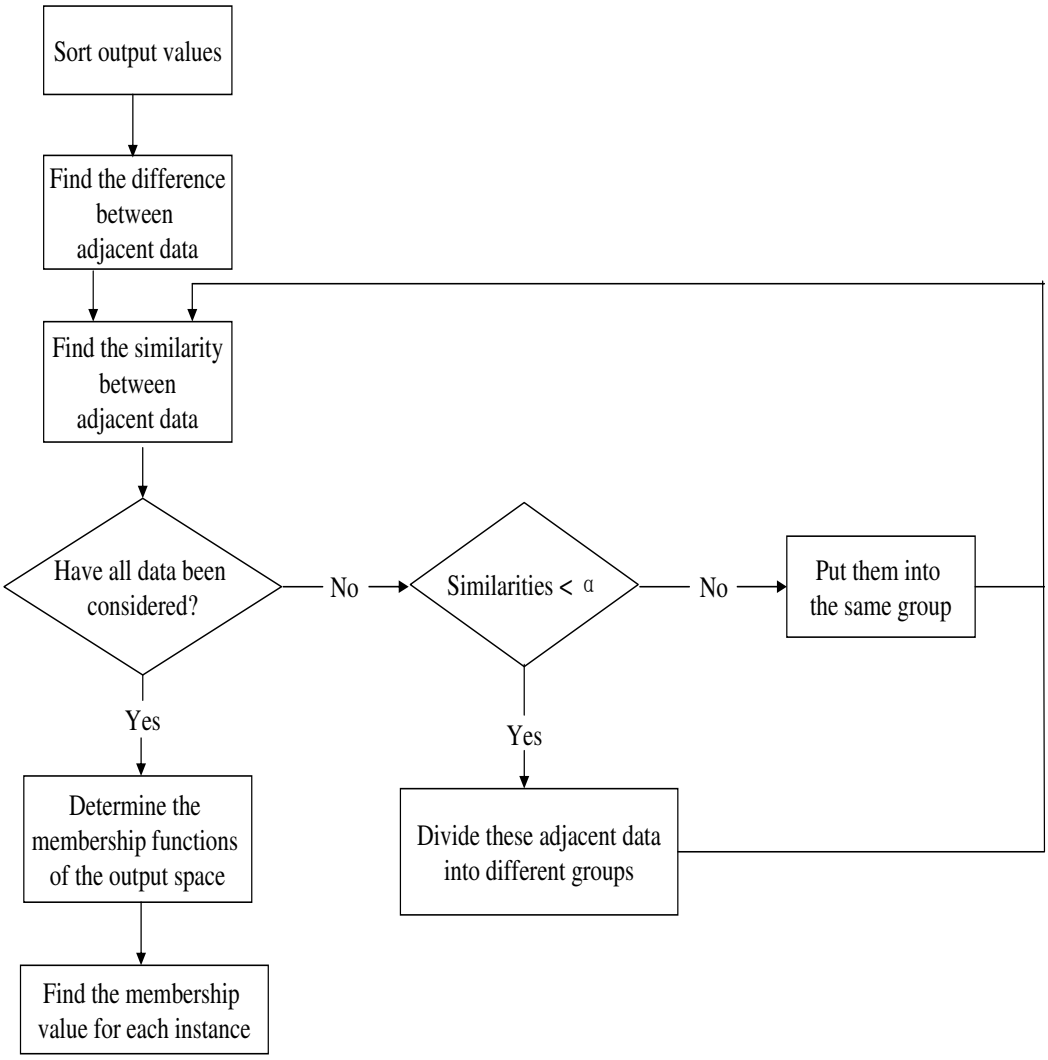

Fig. 4. The flow chart of step 1.

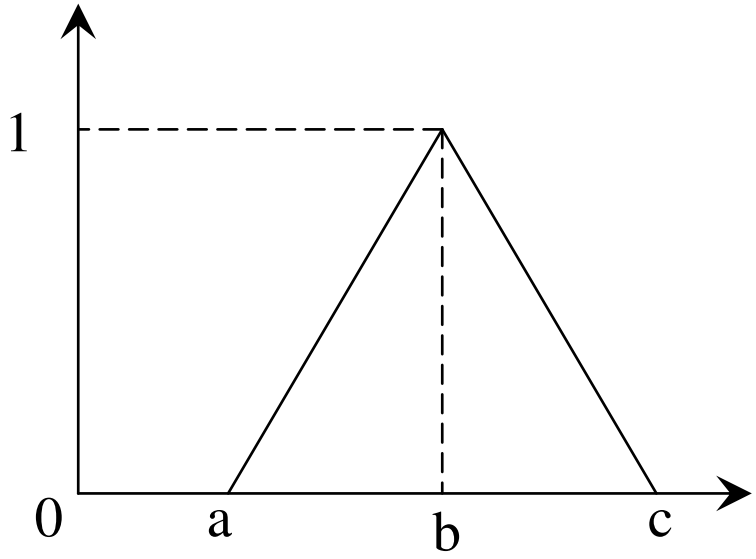

Fig. 5. A triangle membership function.

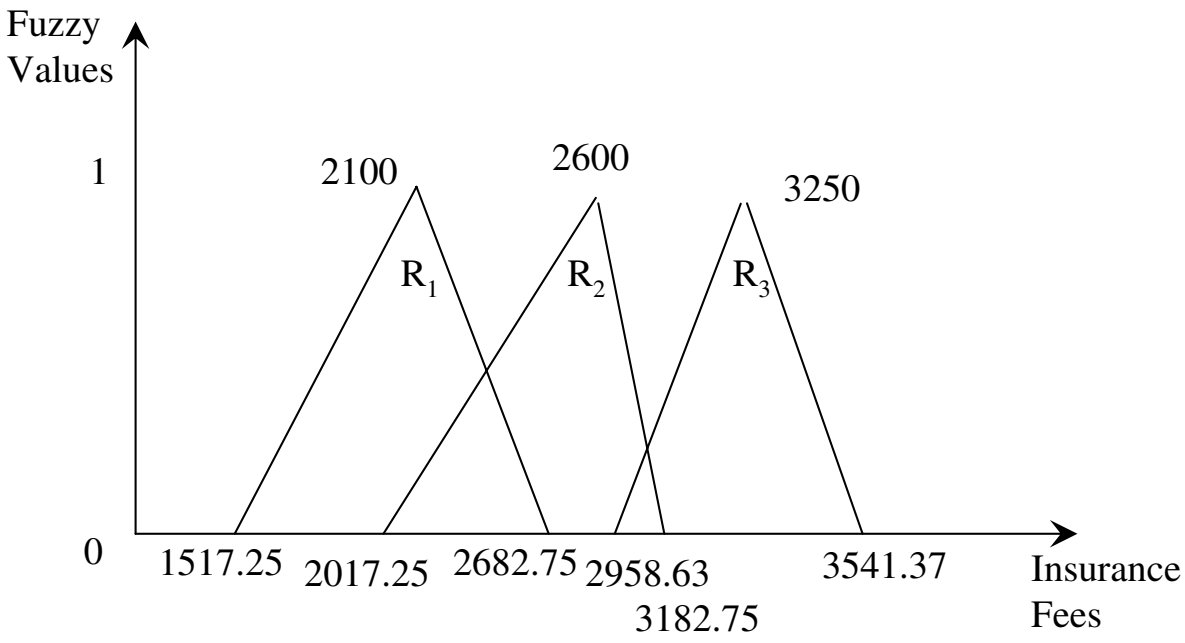

Fig. 6. Insurance fee membership functions.

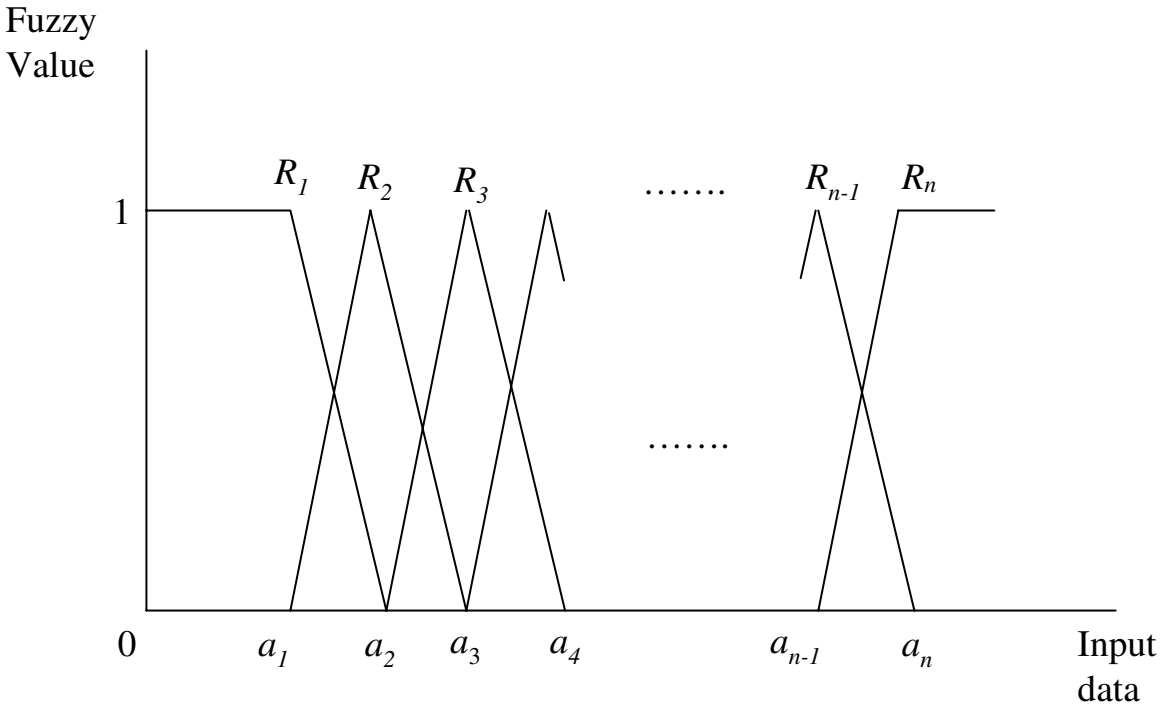

Fig. 7. Initial membership functions.

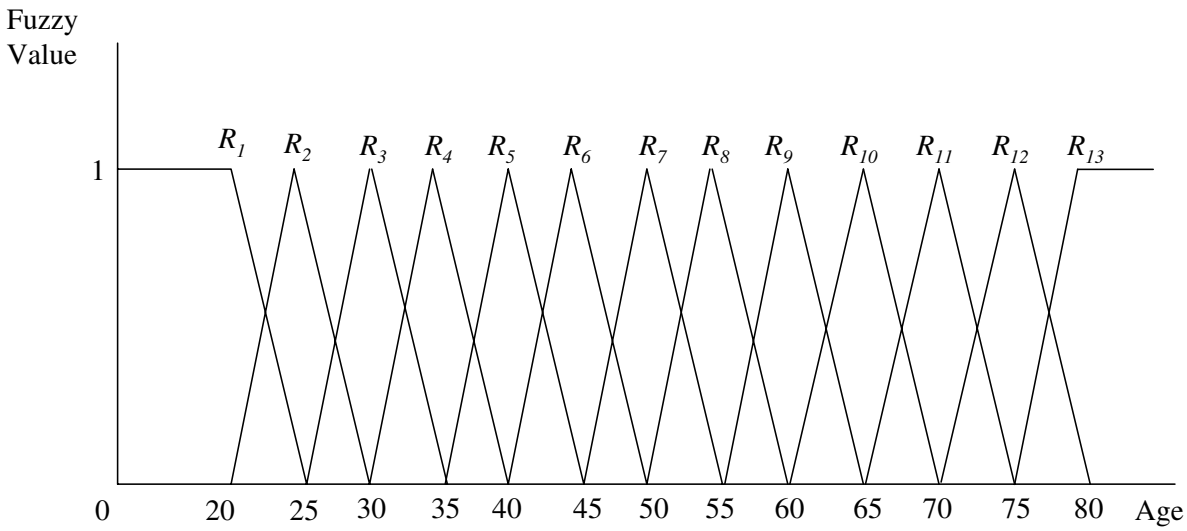

Fig. 8. Initial membership functions of age.

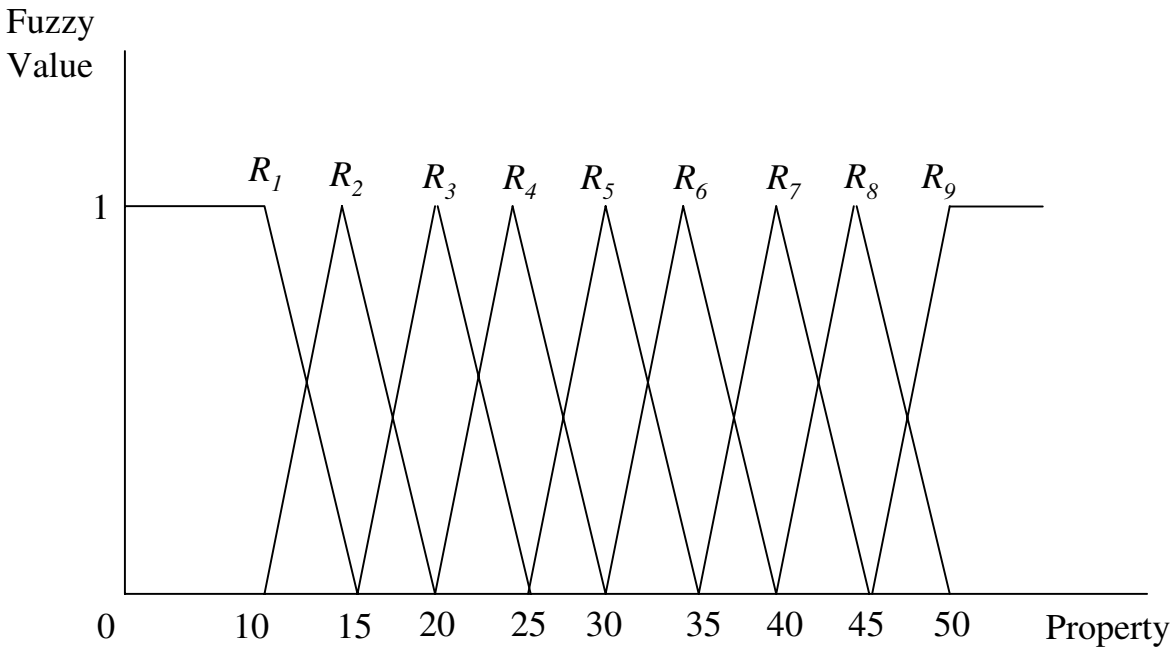

Fig. 9. Initial membership functions of property.

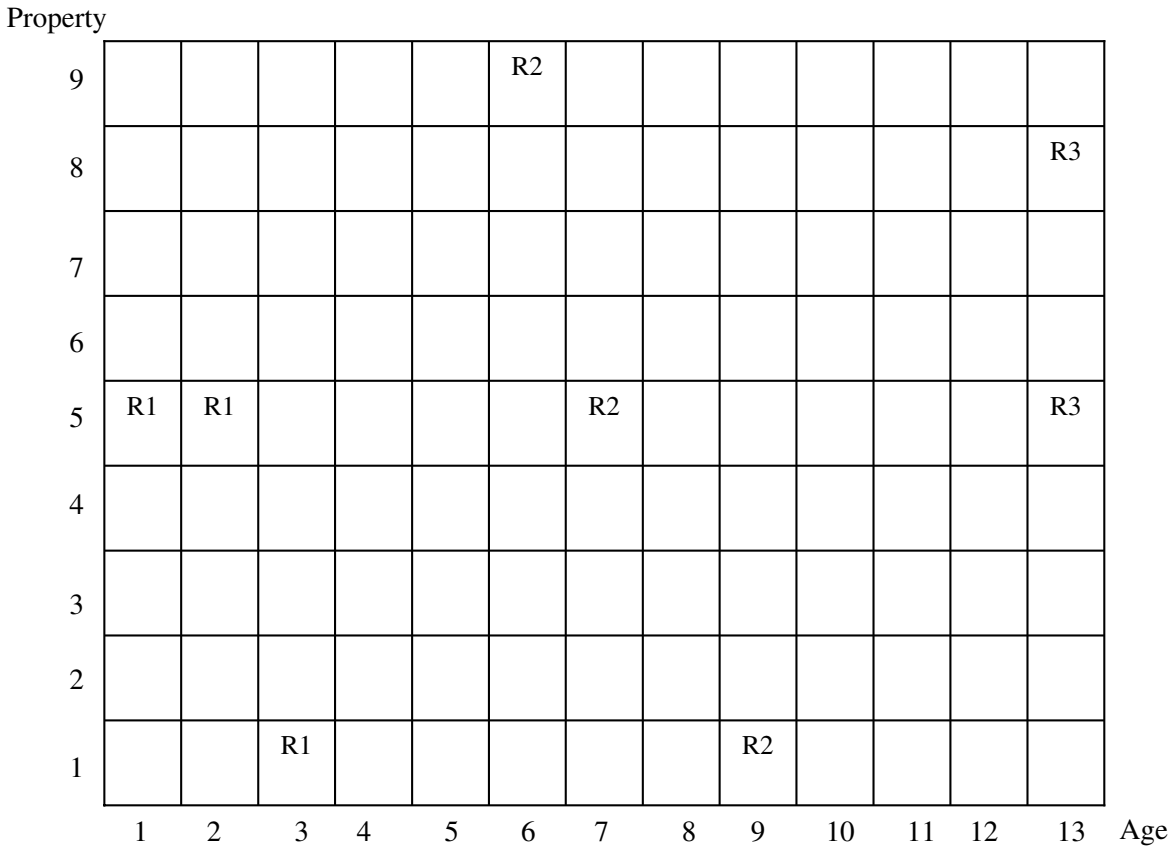

Fig. 10. Initial decision table for insurance problem.

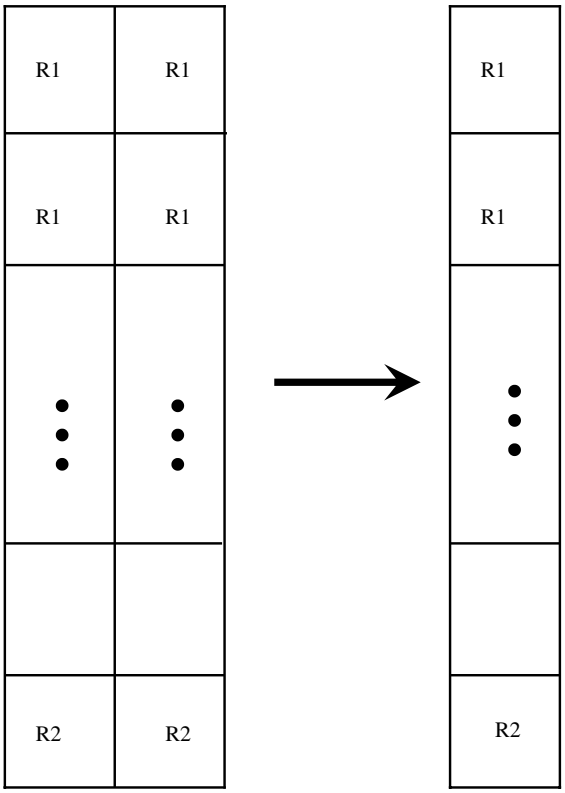

Fig. 11. An example of Operation 1.

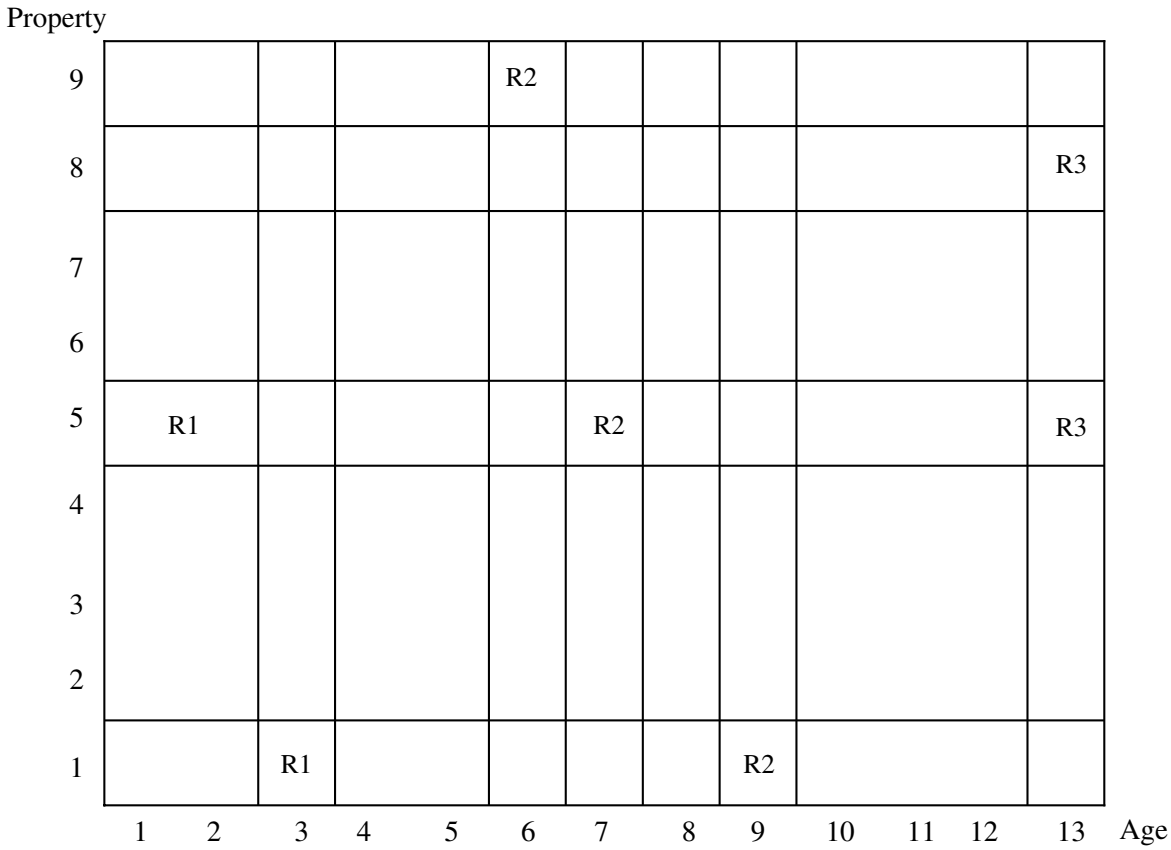

Fig. 12. The results after Operation 1.

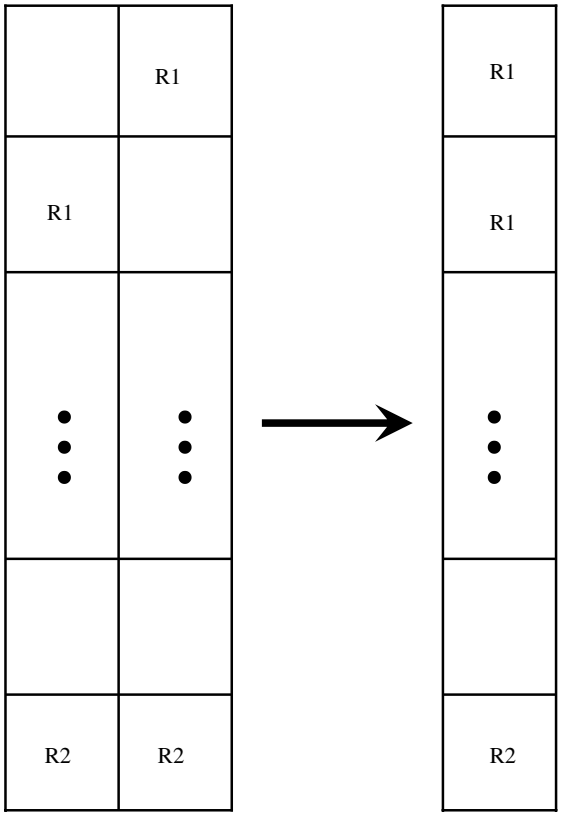

Fig. 13. An example of Operation 2.

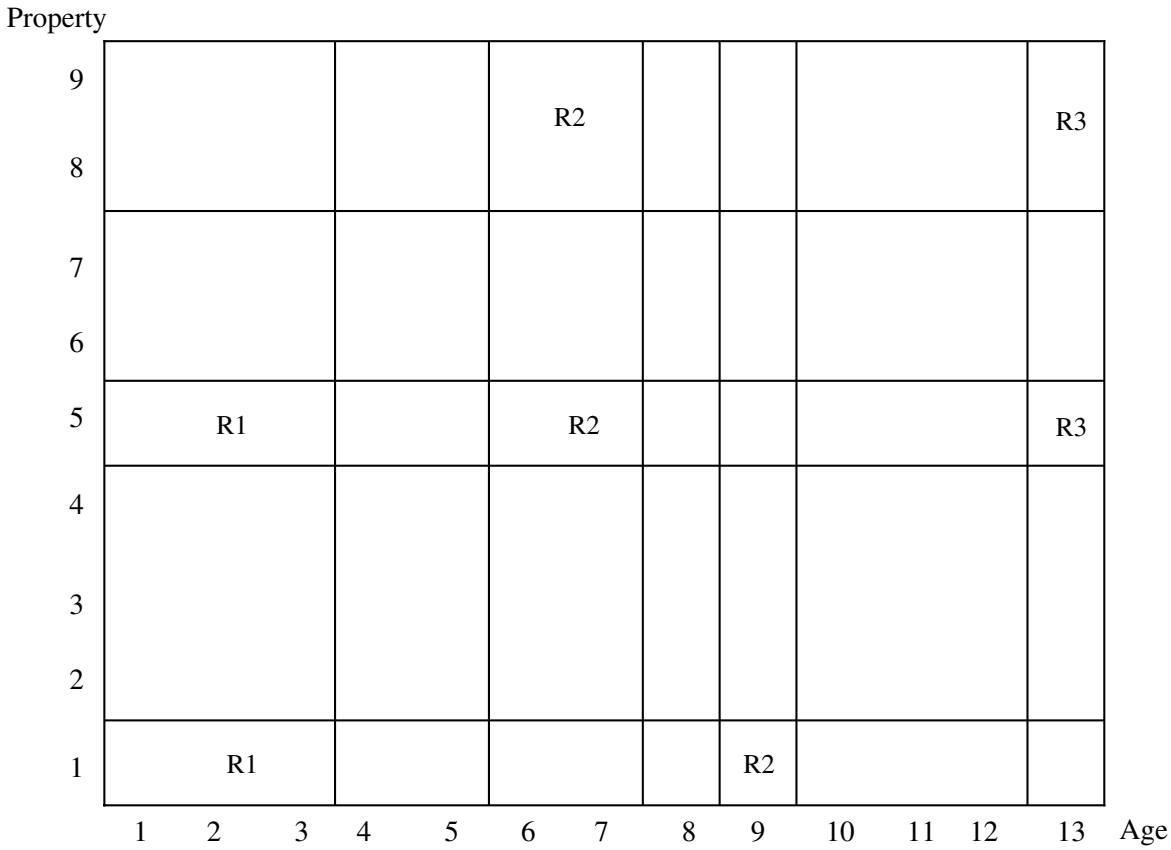

Fig. 14. The results after Operation 2.

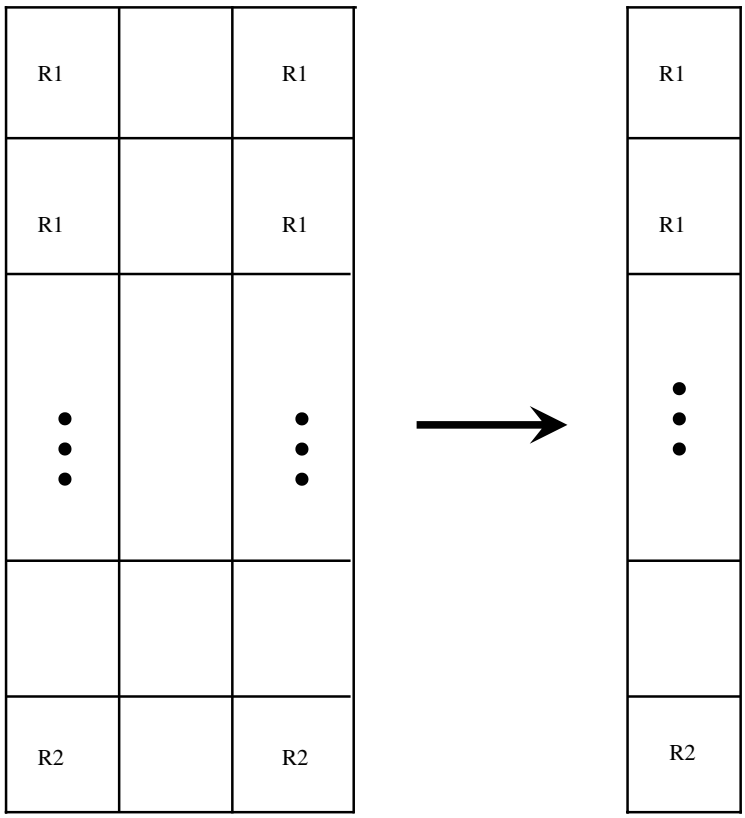

Fig. 15. An example of Operation 3.

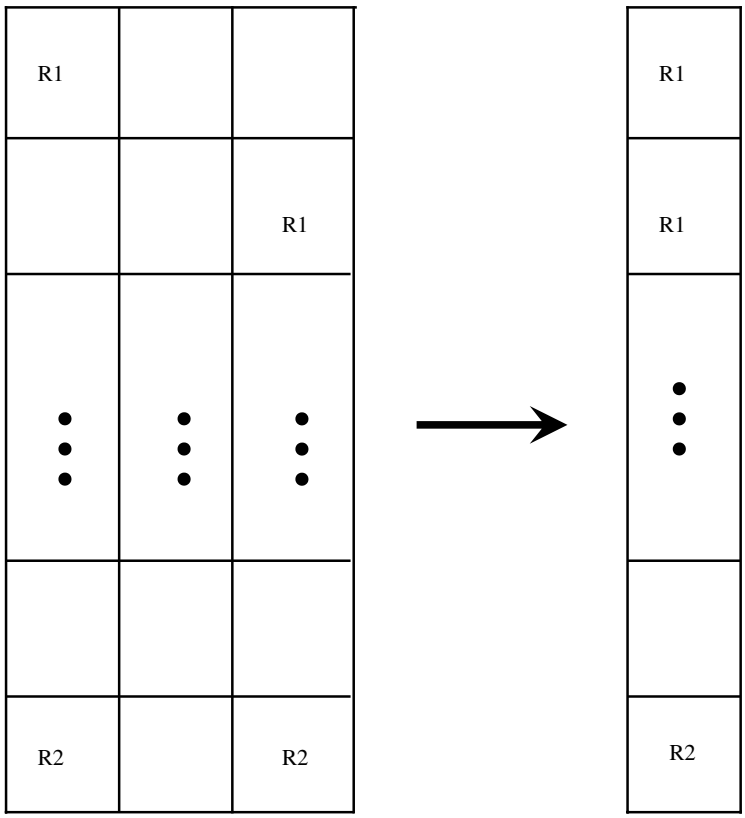

Fig. 16. An example of Operation 4.

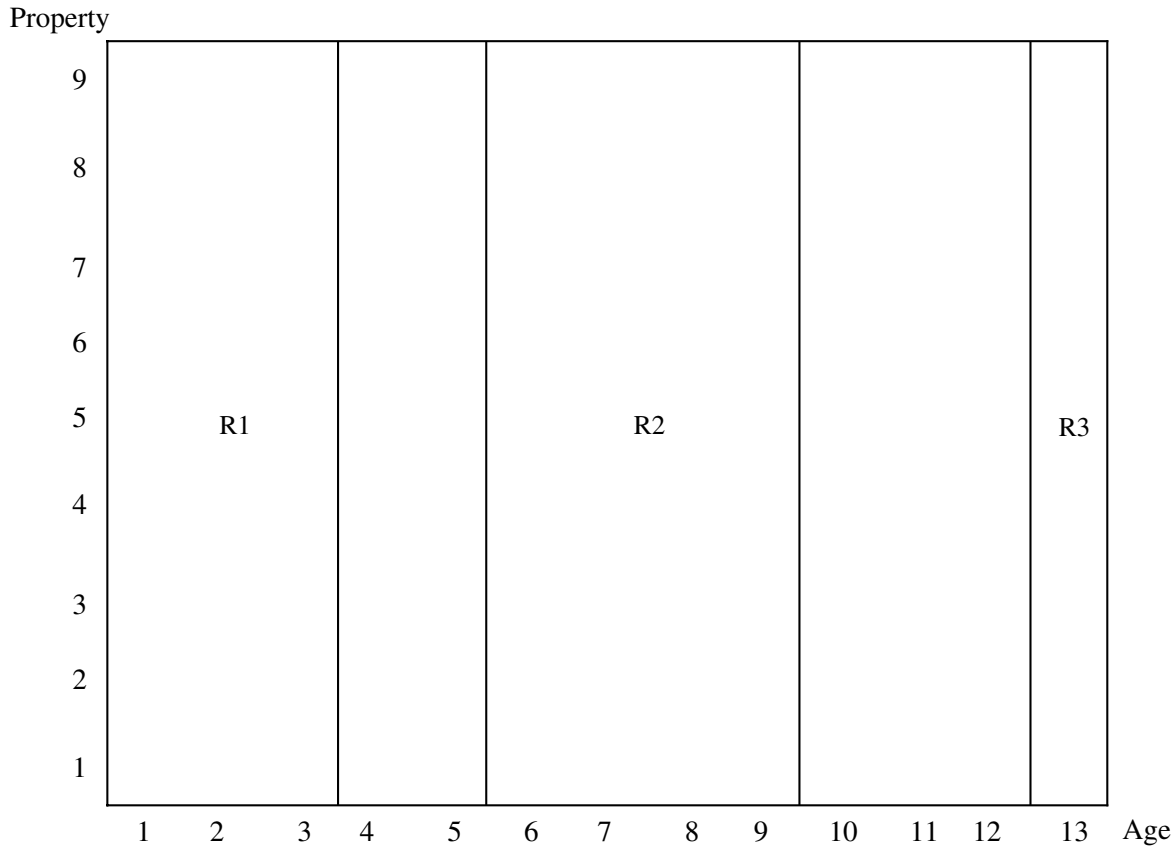

Fig. 17. The results after Operation 3 and 4.

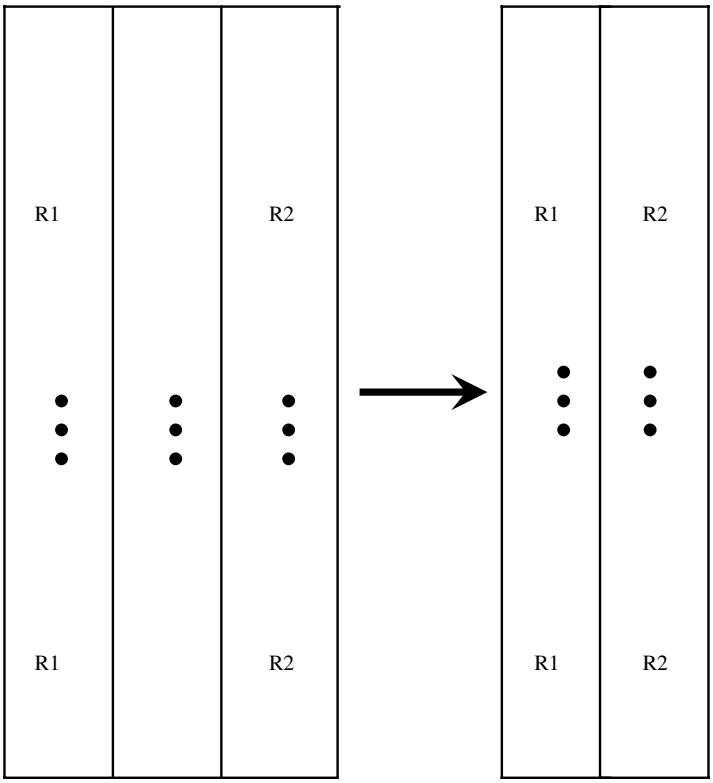

Fig. 18. An example of Operation 5.

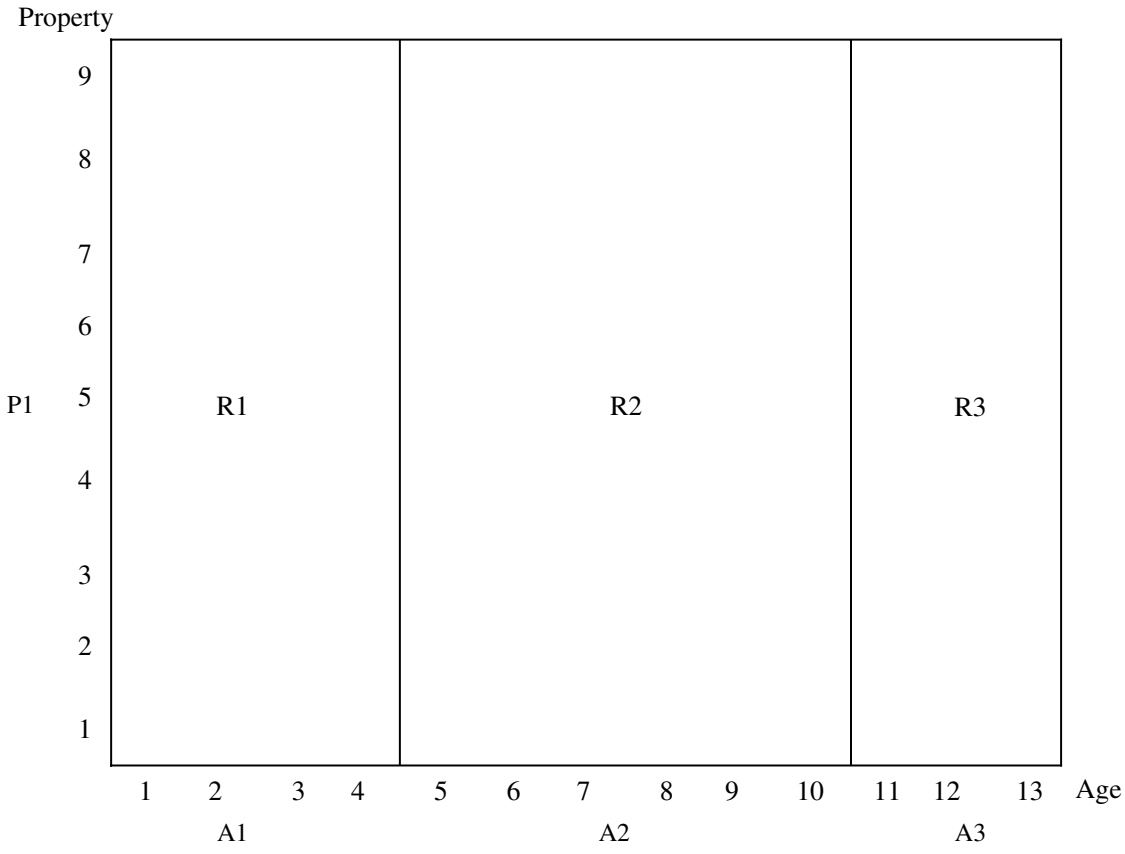

Fig. 19. The results after Operation 5.

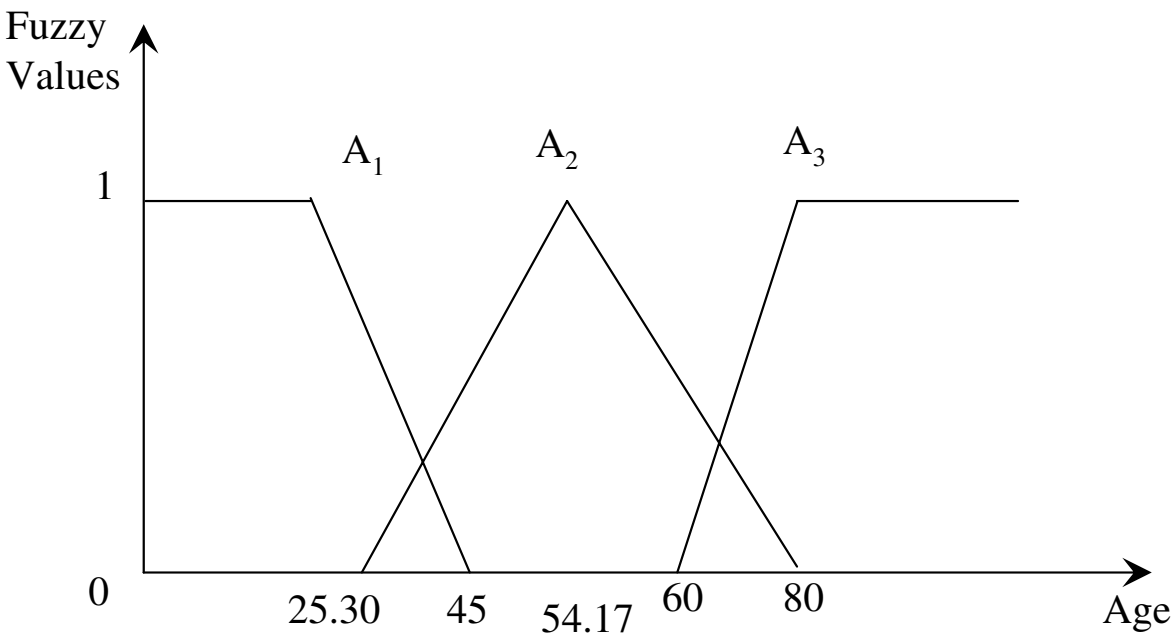

Fig. 20. Final membership functions for age.

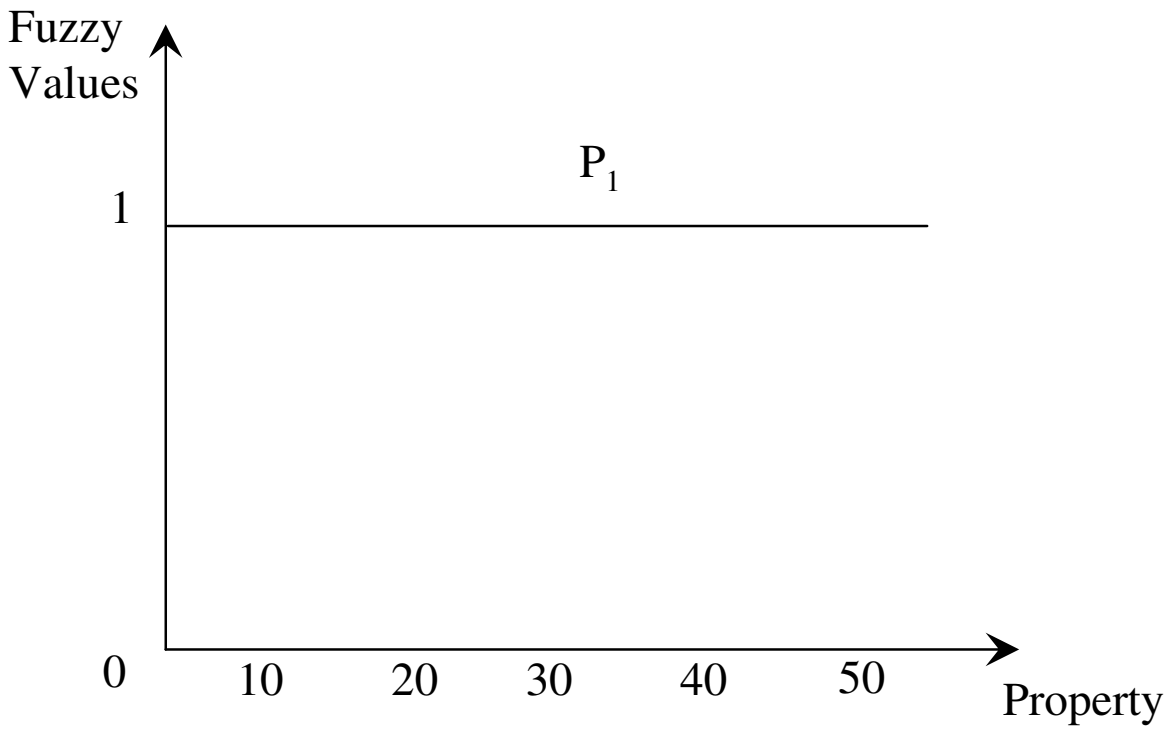

Fig. 21. Final membership function for property.

Training examples	Testing result	Error rate %	Average error rate (%)
(20, 30; 2000)	2100	5	
(25, 30; 2100)	2100	0	
(30, 10; 2200)	2185.704	0.65	
(45, 50; 2500)	2442.818	2.28	
(50, 30; 2600)	2528.522	2.75	1.94
(60, 10; 2700)	2746.709	1.73	
(80, 30; 3200)	3250	1.56	
(80, 40; 3300)	3250	1.52	

Table 1 Testing training examples