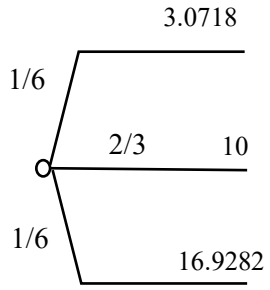
Decision Analysis
Solutions to Homework #6

Question 1

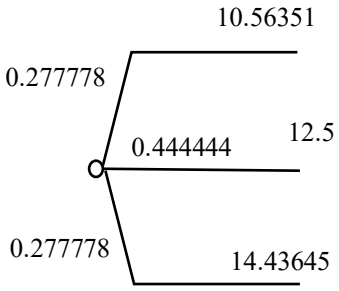
(***a***) Normal distribution with *mean* = 10 and *standard deviation* = 4



3-branch discrete distribution:

$p_1 = 1/6$ $x_1 = 10 - 1.73205\ (4) = 3.0718$
$p_2 = 2/3$ $x_2 = 10 + 0\ (4) = 10$
$p_3 = 1/6$ $x_3 = 10 + 1.73205\ (4) = 16.9282$

(***b***) Uniform distribution with *min*=10, *max*=15.

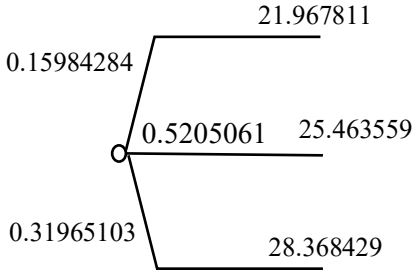


3-branch discrete distribution:

$p_1 = 0.277778$ $x_1 = 10 + 0.112702\ (15 - 10) = 10.56351$
$p_2 = 0.444444$ $x_2 = 10 + 0.5\ (15 - 10) = 12.5$
$p_3 = 0.277778$ $x_1 = 10 + 0.887298\ (15 - 10\ ) = 14.43645$

(*c*) Triangular distribution with *min*=20*, max* =30*, mode*=27.5.

Shape factor = (27.5 – 20)/(30 – 20) = 0.75



3-branch discrete distribution:

$p_1 = 0.15984284$ $x_1 = 20 + 0.1967811\ (30 - 20) = 21.967811$
$p_2 = 0.52050614$ $x_2 = 20 + 0.5463559\ (30 - 20) = 25.463559$
$p_3 = 0.31965103$ $x_3 = 20 + 0.8368429\ (30 - 20) = 28.368429$

Question 2

Computing the weights for the level-2 criteria using either Power Iteration or Linear Algebra method:

Goal	Cost	User-friendliness	Software availability	Weight
Cost	1	1/4	1/5	0.09739
User-friendliness	4	1	1/2	0.33307
Software availability	5	2	1	0.56954
			λ=	3.02460
			CR=	0.02120

< 0.1

Level 3 (alternatives) pairwise comparisons:

Cost	Computer 1	Computer 2	Computer 3	Weight
Computer 1	1	3	5	0.64833
Computer 2	1/3	1	2	0.22965
Computer 3	1/5	1/2	1	0.12202
			λ=	3.00369
			CR=	0.00318

< 0.1

User-friendliness	Computer 1	Computer 2	Computer 3	Weight
Computer 1	1	1/3	1/2	0.14662
Computer 2	3	1	5	0.65707
Computer 3	2	1/5	1	0.19631
			λ=	3.16323
			CR=	0.14072

> 0.1

Software availability	Computer 1	Computer 2	Computer 3	Weight
Computer 1	1	1/3	1/7	0.08096
Computer 2	3	1	1/5	0.18839
Computer 3	7	5	1	0.73064
			λ=	3.06489
			CR=	0.05594

< 0.1

Alternative	**Global Weight**
Computer 1	0.15809
Computer 2	0.34851
Computer 3	**0.49340**

(*a*) The company should choose Computer 3, which has the highest global weight.

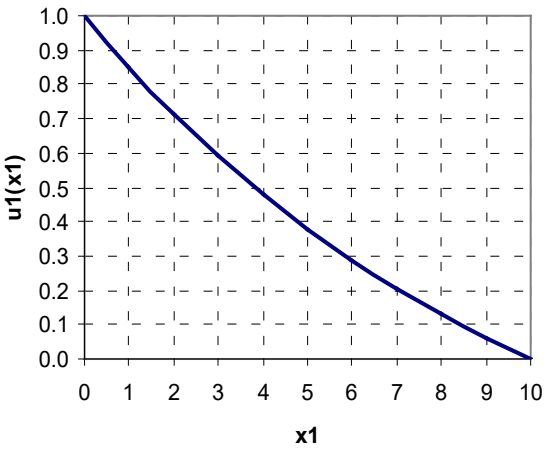
(*b*) Only the pairwise comparison matrix for "user friendliness" has CR > 10%.

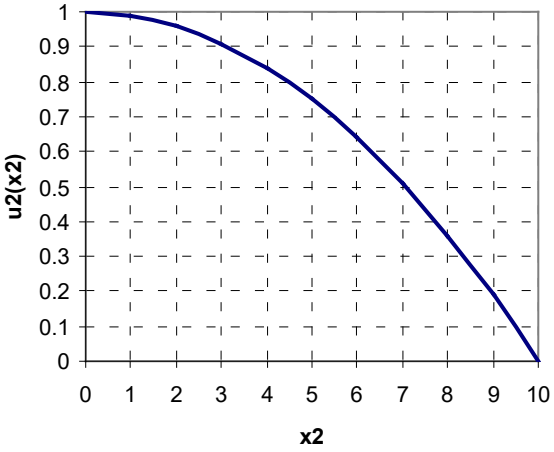
Question 3

x_1 = Weekly blood shortage $(0 \le x_1 \le 10)$
x_2 = Weekly blood outdated $(0 \le x_2 \le 10)$

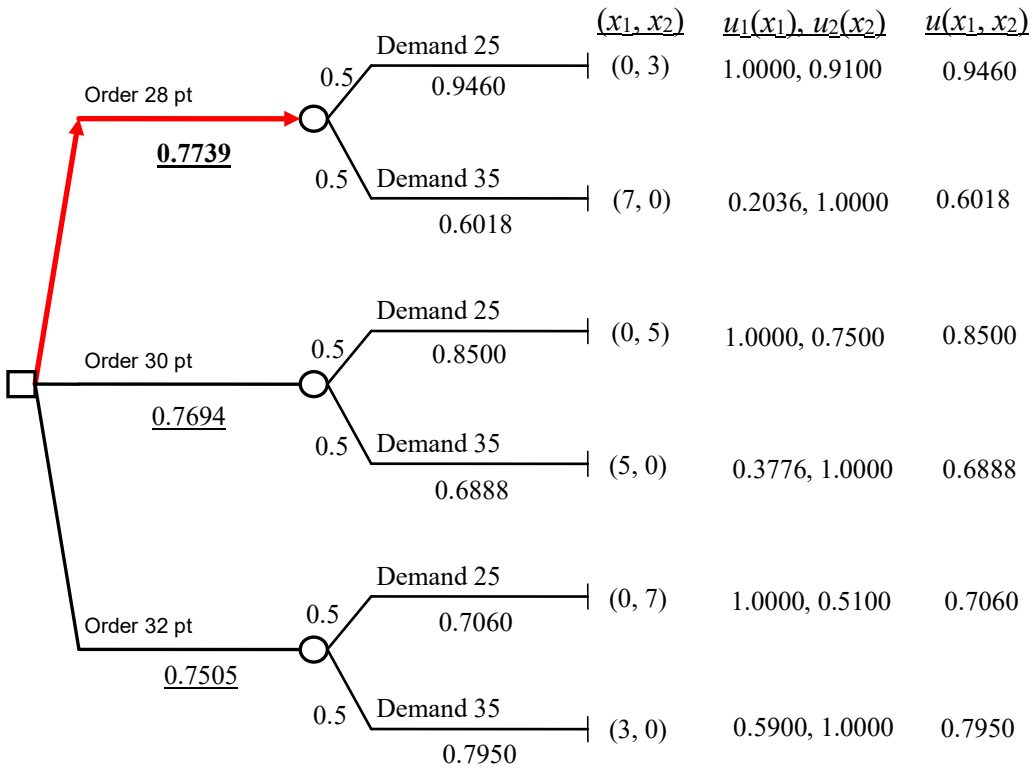
$$u(x_1, x_2) = 0.4\,u_1(x_1) + 0.5\,u_2(x_2) + 0.1\,u_1(x_1)\,u_2(x_2)$$

where $u_1(x_1) = 0.582\left[\exp(1 - \frac{x_1}{10}) - 1\right]$ and $u_2(x_2) = 1 - \frac{x_2^2}{100}$.





The decision tree is



Conclusion: The hospital should order 28 pints of blood weekly.