P(1)

(a).
$$P(w=we) = \frac{1}{3} \times \frac{13}{12+12+1+1+13} + \frac{1}{3} \times \frac{17}{17+17+0+0+17} + \frac{1}{3} \times \frac{15}{14+14+2+2+15}$$

= 0.32860422

(b)
$$P\left(\frac{Document=1}{Word=we}\right) = \frac{0.00854}{0.0227313} = \boxed{0.3760}$$

$$P(word=we) = \frac{1}{3} \times \frac{1}{12+12+1+1+13} + \frac{1}{3} \times \frac{0}{17+17+0+0+17} + \frac{1}{3} \times \frac{2}{14+14+2+2+15}$$

= 0.0227313

$$P(word=we \text{ from } Document=1) = \frac{1}{3} \times \frac{1}{12+12+1+1+13}$$

= 0.00854

(c)

$$P\left(\frac{Document=2}{Word=am \text{ or } Word=are}\right) = \boxed{0.3310}$$

$$P(~~Document~~(word=am \text{ or } Word=are))$$

$$= \frac{1}{3} \times \frac{12+1}{12+12+1+1+13} + \frac{1}{3} \times \frac{17+0}{17+17+0+0+17} + \frac{1}{3} \times \frac{14+2}{14+14+2+2+15} = 0.3356...$$

$$P(Document=2 \text{ and } (word=am \text{ or } word=are))$$

$$= \frac{1}{3} \times \frac{17+0}{17+17+0+0+17} = 0.1111$$

(d)
$$P(word=groot) = \frac{1}{6} \times \frac{13}{12+12+1+1+13} + \frac{1}{3} \times \frac{17}{17+17+0+0+17} + \frac{1}{2} \times \frac{15}{14+14+2+2+15}$$

(e)
$$P\left(\frac{Document=1 \text{ and } word=we}{Word=we}\right)$$

= 0.3262

= 0.16436538

$P(doc=1$ and $word=we)$

$$= \frac{1}{6} \times \frac{1}{12+12+1+1+13} \qquad = 0.0042735$$

$P(word=we)$

0.026

$$= \frac{1}{6} \times \frac{1}{12+12+1+1+13} + \frac{1}{3} \times \frac{0}{17+17+0+0+17} + \frac{1}{2} \times \frac{2}{14+14+2+2+15}$$

(f)

$$P\left(\frac{Doc=2 \text{ and } (Word=am \text{ or } Word=are)}{Word=am \text{ or } Word=are}\right) \qquad = \qquad 0.3298$$

$P(Doc=2$ and $(Word=am$ or $word=are))$

$$= \frac{1}{3} \times \frac{17+0}{17+17+0+0+17} \qquad = \qquad 0.1111$$

$P(Word=am$ or $Word=are)$

$$= \frac{1}{6} \times \frac{12+1}{12+12+1+1+13} + \frac{1}{3} \times \frac{17+0}{17+17+0+0+17} + \frac{1}{2} \times \frac{14+2}{14+14+2+2+15}$$

$$= \qquad 0.33687$$