



# Topic Models

Machine Learning: Jordan Boyd-Graber  
University of Maryland

EXAMPLE

## Content Questions

## Sampling Token A

### Assignments

$\text{Doc}_1 : z_A = 1, z_B = 2, z_C = 3, z_D = 1$

$\text{Doc}_2 : z_E = 2, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger dog iron  
pig

**Topic 2** :pig hamburger iron  
cat

**Topic 3** :dog iron cat

## Sampling Token A

### Assignments

Doc<sub>1</sub> :  $z_A = 1, z_B = 2, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

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### Topics

**Topic 1** :hamburger dog iron  
pig

**Topic 2** :pig hamburger iron  
cat

**Topic 3** :dog iron cat

$$\blacksquare p(z_A = 1) = \left( \frac{1+1.000}{3+3.000} \right) \times \left( \frac{0+1.000}{3+5.000} \right) = 0.333 \times 0.125 = 0.042 = 0.042$$

## Sampling Token A

### Assignments

Doc<sub>1</sub> :  $z_A = 1, z_B = 2, z_C = 3, z_D = 1$

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### Topics

**Topic 1** :hamburger dog iron pig

**Topic 2** :pig hamburger iron cat

**Topic 3** :dog iron cat

- $p(z_A = 1) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.333 \times 0.125 = 0.042 = 0.042$
- $p(z_A = 2) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{4+5.000}\right) = 0.333 \times 0.111 = 0.037 = 0.037$

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Doc<sub>1</sub> :  $z_A = 1, z_B = 2, z_C = 3, z_D = 1$

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### Topics

**Topic 1** :hamburger dog iron pig

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**Topic 3** :dog iron cat

- $p(z_A = 1) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.333 \times 0.125 = 0.042 = 0.042$
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- $p(z_A = 3) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.333 \times 0.250 = 0.083 = 0.083$

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### Assignments

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### Topics

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### Topics

**Topic 1** :hamburger dog iron pig

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- $p(z_A = 1) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.333 \times 0.125 = 0.042 = 0.042$
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New assignment for (0, 0): 3



## Sampling Token B

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 2, z_C = 3, z_D = 1$

$\text{Doc}_2 : z_E = 2, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

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cat

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## Sampling Token B

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 2, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

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cat

**Topic 3** :dog dog iron cat

$$\blacksquare p(z_B = 1) = \left( \frac{1+1.000}{3+3.000} \right) \times \left( \frac{0+1.000}{3+5.000} \right) = 0.333 \times 0.125 = 0.042 = 0.042$$

## Sampling Token B

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 2, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

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- $p(z_B = 1) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.333 \times 0.125 = 0.042 = 0.042$
- $p(z_B = 2) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$

## Sampling Token B

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 2, z_C = 3, z_D = 1$

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Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

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- $p(z_B = 1) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.333 \times 0.125 = 0.042 = 0.042$
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- $p(z_B = 3) = \left(\frac{2+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{4+5.000}\right) = 0.500 \times 0.222 = 0.111 = 0.111$

## Sampling Token B

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 2, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

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- $p(z_B = 1) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.333 \times 0.125 = 0.042 = 0.042$
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Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

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cat

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New assignment for (0, 1): 3

## Sampling Token C

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 1$

$\text{Doc}_2 : z_E = 2, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

**Topic 2** :pig hamburger iron

**Topic 3** :dog dog iron cat cat

## Sampling Token C

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

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$$\blacksquare p(z_C = 1) = \left( \frac{1+1.000}{3+3.000} \right) \times \left( \frac{0+1.000}{3+5.000} \right) = 0.333 \times 0.125 = 0.042 = 0.042$$



## Sampling Token C

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

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New assignment for (0, 2): 3

## Sampling Token D

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 1$

$\text{Doc}_2 : z_E = 2, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

**Topic 2** :pig hamburger iron

**Topic 3** :dog dog iron cat cat

## Sampling Token D

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

**Topic 2** :pig hamburger iron

**Topic 3** :dog dog iron cat cat

$$\blacksquare p(z_D = 1) = \left( \frac{0+1.000}{3+3.000} \right) \times \left( \frac{0+1.000}{2+5.000} \right) = 0.167 \times 0.143 = 0.024 = 0.024$$

## Sampling Token D

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

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- $p(z_D = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.167 \times 0.143 = 0.024 = 0.024$
- $p(z_D = 2) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.167 \times 0.250 = 0.042 = 0.042$

## Sampling Token D

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

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Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

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**Topic 3** :dog dog iron cat cat

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- $p(z_D = 3) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{5+5.000}\right) = 0.667 \times 0.100 = 0.067 = 0.067$



## Sampling Token D

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron pig

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- $p(z_D = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.167 \times 0.143 = 0.024 = 0.024$
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- $p(z_D = 3) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{5+5.000}\right) = 0.667 \times 0.100 = 0.067 = 0.067$

## Sampling Token D

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 1$

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- $p(z_D = 3) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{5+5.000}\right) = 0.667 \times 0.100 = 0.067 = 0.067$

New assignment for (0, 3): 3

## Sampling Token E

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 2, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron

**Topic 2** :pig hamburger iron

**Topic 3** :pig dog dog iron cat  
cat

## Sampling Token E

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

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cat

$$\blacksquare p(z_E = 1) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.400 \times 0.286 = 0.114 = 0.114$$

## Sampling Token E

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

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- $p(z_E = 1) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.400 \times 0.286 = 0.114 = 0.114$
- $p(z_E = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$

## Sampling Token E

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron

**Topic 2** :pig hamburger iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_E = 1) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.400 \times 0.286 = 0.114 = 0.114$
- $p(z_E = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_E = 3) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{6+5.000}\right) = 0.400 \times 0.091 = 0.036 = 0.036$

## Sampling Token E

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron

**Topic 2** :pig hamburger iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_E = 1) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.400 \times 0.286 = 0.114 = 0.114$
- $p(z_E = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_E = 3) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{6+5.000}\right) = 0.400 \times 0.091 = 0.036 = 0.036$

## Sampling Token E

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 2, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger iron

**Topic 2** :pig hamburger iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_E = 1) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.400 \times 0.286 = 0.114 = 0.114$
- $p(z_E = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_E = 3) = \left(\frac{1+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{6+5.000}\right) = 0.400 \times 0.091 = 0.036 = 0.036$

New assignment for (1, 0): 1



## Sampling Token F

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger iron

**Topic 2** :pig iron

**Topic 3** :pig dog dog iron cat  
cat

## Sampling Token F

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger iron

**Topic 2** :pig iron

**Topic 3** :pig dog dog iron cat  
cat

$$\blacksquare p(z_F = 1) = \left( \frac{2+1.000}{2+3.000} \right) \times \left( \frac{0+1.000}{3+5.000} \right) = 0.600 \times 0.125 = 0.075 = 0.075$$

## Sampling Token F

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger iron

**Topic 2** :pig iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_F = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.600 \times 0.125 = 0.075 = 0.075$
- $p(z_F = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$

## Sampling Token F

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger iron

**Topic 2** :pig iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_F = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.600 \times 0.125 = 0.075 = 0.075$
- $p(z_F = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_F = 3) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{5+5.000}\right) = 0.200 \times 0.200 = 0.040 = 0.040$

## Sampling Token F

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 3, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger iron

**Topic 2** :pig iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_F = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.600 \times 0.125 = 0.075 = 0.075$
- $p(z_F = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_F = 3) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{5+5.000}\right) = 0.200 \times 0.200 = 0.040 = 0.040$

## Sampling Token F

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 3, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger iron

**Topic 2** :pig iron

**Topic 3** :pig dog dog iron cat  
cat

- $p(z_F = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.600 \times 0.125 = 0.075 = 0.075$
- $p(z_F = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_F = 3) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{5+5.000}\right) = 0.200 \times 0.200 = 0.040 = 0.040$

New assignment for (1, 1): 1

## Sampling Token G

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 1, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

## Sampling Token G

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

$$\blacksquare p(z_G = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.600 \times 0.250 = 0.150 = 0.150$$



## Sampling Token G

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_G = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.600 \times 0.250 = 0.150 = 0.150$
- $p(z_G = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$

## Sampling Token G

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_G = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.600 \times 0.250 = 0.150 = 0.150$
- $p(z_G = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_G = 3) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{5+5.000}\right) = 0.200 \times 0.100 = 0.020 = 0.020$

## Sampling Token G

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_G = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.600 \times 0.250 = 0.150 = 0.150$
- $p(z_G = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_G = 3) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{5+5.000}\right) = 0.200 \times 0.100 = 0.020 = 0.020$

## Sampling Token G

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_G = 1) = \left(\frac{2+1.000}{2+3.000}\right) \times \left(\frac{1+1.000}{3+5.000}\right) = 0.600 \times 0.250 = 0.150 = 0.150$
- $p(z_G = 2) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{2+5.000}\right) = 0.200 \times 0.143 = 0.029 = 0.029$
- $p(z_G = 3) = \left(\frac{0+1.000}{2+3.000}\right) \times \left(\frac{0+1.000}{5+5.000}\right) = 0.200 \times 0.100 = 0.020 = 0.020$

New assignment for (1, 2): 1

## Sampling Token H

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 1, z_G = 1$

$\text{Doc}_3 : z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

## Sampling Token H

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

$$\blacksquare p(z_H = 1) = \left( \frac{0+1.000}{3+3.000} \right) \times \left( \frac{0+1.000}{3+5.000} \right) = 0.167 \times 0.125 = 0.021 = 0.021$$

## Sampling Token H

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_H = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_H = 2) = \left(\frac{2+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.500 \times 0.286 = 0.143 = 0.143$

## Sampling Token H

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_H = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_H = 2) = \left(\frac{2+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.500 \times 0.286 = 0.143 = 0.143$
- $p(z_H = 3) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{5+5.000}\right) = 0.333 \times 0.200 = 0.067 = 0.067$



## Sampling Token H

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_H = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_H = 2) = \left(\frac{2+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.500 \times 0.286 = 0.143 = 0.143$
- $p(z_H = 3) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{5+5.000}\right) = 0.333 \times 0.200 = 0.067 = 0.067$

## Sampling Token H

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 1, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog iron

**Topic 2** :pig iron

**Topic 3** :pig dog iron cat cat

- $p(z_H = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_H = 2) = \left(\frac{2+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{2+5.000}\right) = 0.500 \times 0.286 = 0.143 = 0.143$
- $p(z_H = 3) = \left(\frac{1+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{5+5.000}\right) = 0.333 \times 0.200 = 0.067 = 0.067$

New assignment for (2, 0): 2

## Sampling Token I

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 1, z_G = 1$

$\text{Doc}_3 : z_H = 2, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron

**Topic 3** :pig dog iron cat cat

## Sampling Token I

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron

**Topic 3** :pig dog iron cat cat

$$\blacksquare p(z_I = 1) = \left( \frac{0+1.000}{3+3.000} \right) \times \left( \frac{0+1.000}{3+5.000} \right) = 0.167 \times 0.125 = 0.021 = 0.021$$

## Sampling Token I

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron

**Topic 3** :pig dog iron cat cat

- $p(z_I = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_I = 2) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{2+1.000}{3+5.000}\right) = 0.667 \times 0.375 = 0.250 = 0.250$

## Sampling Token I

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron

**Topic 3** :pig dog iron cat cat

- $p(z_I = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_I = 2) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{2+1.000}{3+5.000}\right) = 0.667 \times 0.375 = 0.250 = 0.250$
- $p(z_I = 3) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{4+5.000}\right) = 0.167 \times 0.111 = 0.019 = 0.019$

## Sampling Token I

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron

**Topic 3** :pig dog iron cat cat

- $p(z_I = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_I = 2) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{2+1.000}{3+5.000}\right) = 0.667 \times 0.375 = 0.250 = 0.250$
- $p(z_I = 3) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{4+5.000}\right) = 0.167 \times 0.111 = 0.019 = 0.019$

## Sampling Token I

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 3, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron

**Topic 3** :pig dog iron cat cat

$$\blacksquare p(z_I = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$$

$$\blacksquare p(z_I = 2) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{2+1.000}{3+5.000}\right) = 0.667 \times 0.375 = 0.250 = 0.250$$

$$\blacksquare p(z_I = 3) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{4+5.000}\right) = 0.167 \times 0.111 = 0.019 = 0.019$$

New assignment for (2, 1): 2



## Sampling Token J

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 1, z_G = 1$

$\text{Doc}_3 : z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

## Sampling Token J

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

$$\blacksquare p(z_J = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$$

## Sampling Token J

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

$$\blacksquare p(z_J = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$$

$$\blacksquare p(z_J = 2) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.667 \times 0.125 = 0.083 = 0.083$$

## Sampling Token J

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

- $p(z_J = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
- $p(z_J = 2) = \left(\frac{3+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.667 \times 0.125 = 0.083 = 0.083$
- $p(z_J = 3) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{1+1.000}{4+5.000}\right) = 0.167 \times 0.222 = 0.037 = 0.037$

## Sampling Token J

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

- $p(z_J = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
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## Sampling Token J

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

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### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

$$\blacksquare p(z_J = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$$

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New assignment for (2, 2): 2

## Sampling Token K

### Assignments

$\text{Doc}_1 : z_A = 3, z_B = 3, z_C = 3, z_D = 3$

$\text{Doc}_2 : z_E = 1, z_F = 1, z_G = 1$

$\text{Doc}_3 : z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

## Sampling Token K

### Assignments

Doc<sub>1</sub> :  $z_A = 3, z_B = 3, z_C = 3, z_D = 3$

Doc<sub>2</sub> :  $z_E = 1, z_F = 1, z_G = 1$

Doc<sub>3</sub> :  $z_H = 2, z_I = 2, z_J = 2, z_K = 2$

### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

$$\blacksquare p(z_K = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$$



## Sampling Token K

### Assignments

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### Topics

**Topic 1** :hamburger

hamburger dog

**Topic 2** :pig iron iron iron

**Topic 3** :pig dog cat cat

- $p(z_K = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
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### Topics

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- $p(z_K = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
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### Topics

**Topic 1** :hamburger

hamburger dog

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- $p(z_K = 1) = \left(\frac{0+1.000}{3+3.000}\right) \times \left(\frac{0+1.000}{3+5.000}\right) = 0.167 \times 0.125 = 0.021 = 0.021$
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### Topics

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New assignment for (2, 3): 2