

**CS500**  
**Fundamentals of Databases**

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(a)

$\pi_{\text{country}}(\sigma_{\text{continent}=\text{Europe}}(\text{Countries}))$

(b)

$\pi_{\text{country}}(\sigma_{\text{continent}=\text{North America}}(\text{Countries}) \bowtie (\sigma_{\text{population} > 1,000,000}(\text{Cities}) \bowtie (\sigma_{\text{is\_capital}=\text{yes}}(\text{Cities}))))$

(c)

$\sigma_{(\text{country1.population} > \text{country2.population})}(\rho_{\text{country1}}(\sigma_{\text{is\_capital}=\text{yes}}(\text{Cities})) \times (\rho_{\text{country2}}(\sigma_{\text{is\_capital}=\text{yes}}(\text{Cities}))))$

(d)

$\pi_{\text{country}}(\text{Cities}) - \pi_{\text{country}}(\text{Cities} \bowtie (\sigma_{\text{continent}=\text{Europe}}(\text{Countries})))$

(e)

$\pi_{\text{country, capital, not\_capital}}(\text{Countries} \bowtie ((\rho_{\text{capital}}(\sigma_{\text{is\_capital}=\text{yes}}(\text{Cities})) \times (\rho_{\text{not\_capital}}(\sigma_{\text{is\_capital}=\text{no}}(\text{Cities}))))))$