

- Hash index on sid of Sailors
 - sid is key of Sailors so at most 1 matching tuple but sid is foreign key in Reserves so exactly 1 matching tuple in Sailors
 - Total cost is 221,000 I/Os
- Hash index on sid of Reserves
 - Sid not key of Reserves so 1 or more matching tuples
 - Cost of scanning Sailors is 500
 - Cost of using hash index for every tuple is $(500 \times 80) \times 1.2 = 48,000$ I/Os
 - Assuming uniform distribution of reservations to sailors then $(100,000/40,000) = 2.5$ reservations
 - If index on Reserves is clustered then all reservations would likely be on 1 page so accessing matching tuples requires 40,000 I/Os
 - If index on Reserves is unclustered then 1 access per match so $40,000 \times 2.5 = 100,000$ I/Os
 - So in case of clustered index cost of join using index nested loops is $500 + 48,000 + 40,000 = 88,500$ I/Os
 - Assuming 10ms per I/O then time is about 15 minutes
 - So in case of unclustered index cost is $500 + 48,000 + 100,000 = 148,500$
 - Assuming 10 ms per I./O, time is about 25 minutes