**Ski to Sea: Which sport leg is most important?**

The Ski to Sea race is a multi-sport relay race held annually in Whatcom County, Washington. The race consists of seven legs in the order: cross-country skiing, downhill skiing or snowboarding, running, road biking, canoeing, mountain biking, and kayaking, with each leg representing a different outdoor sport. A team will consist of one person for each leg of the race, except for the canoe leg which has two paddlers per canoe. Racers are allowed to compete in multiple legs of the race. A team must have a minimum of three racers and a maximum of eight, with a maximum of three legs per individual. The canoe leg must have two participants regardless of the number or racers per team. The Ski to Sea Race does not allow individuals to complete all legs of the race.

The following matrix reports the correlation between the completion time in minutes for each leg of the race and the overall competition time in minutes:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Overall | Canoe | XC Ski | Downhill Ski | Kayak | Road Bike | Run | XC Bike |
| Overall | 1 | 0.237 | 0.21 | 0.439 | 0.464 | 0.189 | 0.015 | 0.378 |
| Canoe | 0.237 | 1 | 0.361 | -0.186 | 0.428 | -0.126 | -0.587 | -0.055 |
| XC Ski | 0.21 | 0.361 | 1 | 0.184 | 0.357 | 0.226 | 0.034 | 0.193 |
| Downhill | 0.439 | -0.186 | 0.184 | 1 | 0.273 | 0.459 | 0.505 | 0.432 |
| Kayak | 0.464 | 0.428 | 0.357 | 0.273 | 1 | 0.12 | -0.079 | 0.504 |
| Road Bike | 0.189 | -0.126 | 0.226 | 0.459 | 0.12 | 1 | 0.563 | 0.294 |
| Run | 0.015 | -0.587 | 0.034 | 0.505 | -0.079 | 0.563 | 1 | 0.345 |
| XC Bike | 0.378 | -0.055 | 0.193 | 0.432 | 0.504 | 0.294 | 0.345 | 1 |

1. Identify and interpret the correlation between the Road Biking leg and the Overall time?

There is a weak positive correlation between Road Biking and Overall time where r = 0.189.

1. What is the correlation between the Road Bike leg and the XC Bike leg? Is the coefficient lower or higher than you expected? Why?

The correlation between Road Biking and XC Biking is 0.294, which is lower than expected due to the similarity of the legs. This might be because it is hard to find people that are really strong in both, so either someone weaker goes in both events or someone competes in both and is fatigued.

1. How does the correlation between the running leg and the overall competition time compare to the correlation between the Downhill Ski leg and the overall time?

The correlation between the running leg and the overall competition time (r = 0.015) is weaker than the correlation between the road biking leg and the overall time (r = 0.439).

1. Why might running have such a low correlation with overall time?

It could be because it is harder to find a competitor that can dominate the running field compared to other fields. Running is a much more common discipline than others.

1. If a team wants to improve their performance in the running leg, which other leg should they focus on based on the correlation data?

If a team wants to improve their performance in the running leg, they should focus on improving their performance in the road biking leg. The road biking leg shows the strongest positive correlation with the running leg, with a correlation coefficient of 0.563.

1. Which leg of the race shows the strongest positive correlation with the kayaking leg?

The cross country biking leg shows the strongest positive correlation with the kayaking leg, with a correlation coefficient of 0.504.

1. Why might similar disciplines like XC and Downhill Skiing, and XC and Road biking not be very strongly correlated?

The selection of different team members is one possible reason. The XC skier may be much strong than the Downhill Skier or the reverse. Another possible reason is fatigue, as the Skiing legs are back to back, and the XC biking leg is after the Road biking leg. The disciplines are also not exactly the same, so while someone may be a very strong biker on the road, they may struggle while not biking on roads.

1. Which leg of the Ski to Sea race shows the strongest correlation with the overall competition time? Why might this be the case?

The kayak leg shows the strongest correlation with the overall competition time, with a correlation coefficient of 0.464. If a team wants to focus on improving their overall time, they should prioritize the kayak leg of the race. The Kayak leg is also a sea kayaking leg, which means that more experienced competitors will be much more efficient if conditions are bad and could lead to better times. It is also the last leg so fatigue is at its highest level.