A "Wild West" Dynamic Simulation Model: Horses

As part of its program to restore the area's natural ecosystem, the federal government is trying to eliminate wild horses from the Grand River National Wilderness. Your company, Westland Wranglers Inc. (WWI), has a contract with the government to capture the horses. Fortunately, ranchers and hobbyists from neighbouring areas are willing to purchase the horses, so they do not have to be destroyed.

The number of horses your cowboys capture each day is well-modeled by a Poisson random variable with a mean value of 4. You charge your customers $150 each for the horses, and at that price the daily demand for them is well-modeled by a Poisson random variable with mean 4.1. If demand exceeds the number of horses you have available, you lose the additional sales.

Any horses that are not sold at the end of the day are placed in a corral. The cost of keeping a horse in the corral for one night is $8, which covers feed, water, and sanitation. These horses are available for sale the following day, along with newly captured horses.

However, only a limited number of horses can fit in a corral. If there are too many horses to fit, the extra ones must be released.

WWI is considering four different options for the corral:

1. Rent a small corral, holding up to five horses, for $35 per day.

2. Rent a medium-sized corral, holding up to ten horses, for $50 per day.

3. Rent both the small and medium-sized corrals. This option would in effect yield a combined corral holding 5 + 10 = 15 horses at a rent of $35 + $50 = $85 per day.

4. Don't rent a corral. This option may be considered as equivalent to a corral holding zero horses at a cost of $0 per day.

Which option will earn the greatest expected profit? Evaluate each option based on 500 trials, each trial simulating 100 consecutive days of operation. Horses left in the corral at the end of 100 days should be assigned a "salvage" value of $130. You are also interested in how many horses, on average, are left in the corral at the end of each day, and the probability that your total profit, without the salvage adjustment, will be less than $45,000.