Calculator Blackjack

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Professional Development from Texas Instruments

Student Activity

7 8 9 10 11 12

TI-Nspire | Investigation | Student | 25 min

Introduction

The game of Blackjack allows players to draw cards until they accumulate a total of 21 points. If they exceed 21 points they're bust! In Calculator Blackjack the random number generator is used to produce numbers between 0 and 1. Random numbers are added together and continue to be drawn (generated) until the total exceeds 1.

Question: 1.

Estimate, on average, how many numbers need to be generated for a player to be bust?

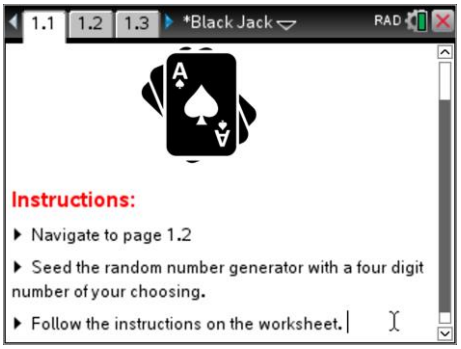
Playing the Game

Open the TI-Nspire file: Blackjack

Navigate to page 1.2 and seed the random number generator using a four digit number of your choosing.

Probability > Random > Seed

Enter your own, unique four (or more) digit number for the random seed. This ensures your results will be unique.



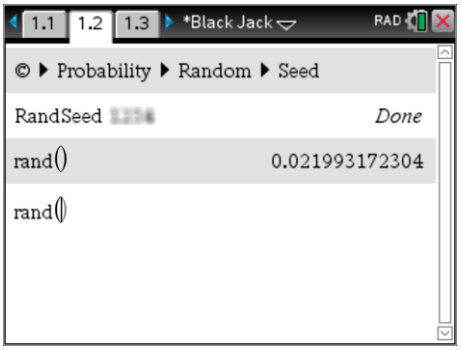
It is time to start playing the game. Using the probability menu once again generate a random number.

Probability > Random > Number

Press **Enter** to generate the random number. This command generates random numbers between 0 and 1. It is therefore not possible to go bust on the first turn.

In the example shown opposite there is a very high probability the game will continue beyond the second random number since the first random number was so small.

Press **Enter** again to generate another random number.



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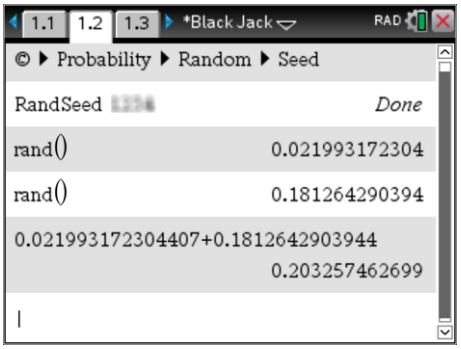
In this hand the first number drawn (generated) was:

0.021993…

The second number was:

0.18126 …

The two numbers can be added together to provide a progressive total, however a faster way to play is to use the 'ANS' command above the (-) key or by typing ANS.

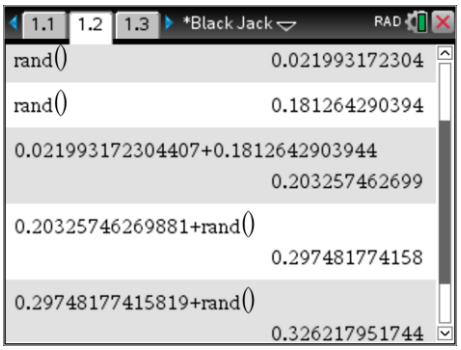


Enter the instructions:

ANS + rand()

This collects the most recent amount and adds a new random number. The game being played here is now up to four random numbers and the progressive total score is still only 0.3262…

The only disadvantage here is that the actual random number that was generated is not displayed, however the focus of this investigation is on how many numbers, on average, will be generated that will cause a player to go 'bust'.



Question: 2.

Play 5 games of Calculator Blackjack and record the results below.

Random Seed number used:

Game	#1	#2	#3	#4	#5
Final Total (Bust)					
Quantity of Numbers					

Question: 3.

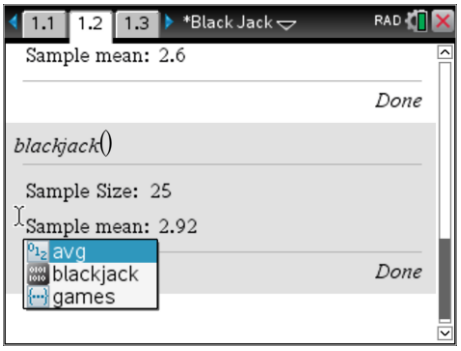
Based on your small 'sample' of five games, how many random numbers on average will make a player 'bust'?

There is a much quicker way to play a large number of games. The Blackjack file includes a program titled: "Blackjack" which can be found in the **VAR** menu.

Select the program and press **Enter** to run it.

Run a simulation of 25 games.

The results of the 25 games displayed simply as the "Sample mean". To see individual game result, select **games** from the **VAR** menu.



Question: 4.

Run 5 simulations of **25** games using the Blackjack program and record the results below.

Sample	#1	#2	#3	#4	#5
Sample Mean					

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Question: 5.

Imagine repeating the 25 game simulations many times over:

a) What would be the likelihood of obtaining a sample average very close to 2?

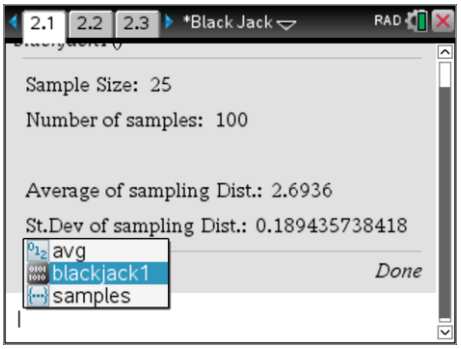
b) What would be the likelihood of obtaining a sample average very close to 4?

c) Describe or graph how the sample means might be distributed.

Navigate to page 2.1 and run the blackjack1() program.

When prompted generate 100 samples each consisting of 25 games.
Watch closely as the mean of each sample is displayed on the screen.

Navigate to page 2.2 to see a graph of the sampling distribution.

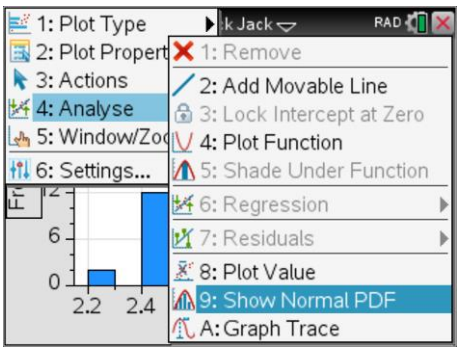


Question: 6.

Describe the sampling distribution.

Change the dot-plot on page 2.2 to a histogram.

Use the **Analyse** menu to generate a **Normal PDF** for the data.



Question: 7.

Record the mean and standard deviation of Normal approximation for the sampling distribution.

Question: 8.

Return to page 2.1, run the blackjack1() program again generating 100 samples each consisting of 100 games. (This will take a little time.)

a) Compare and comment on the mean of this sampling distribution.

b) Compare and comment on the standard deviation of this sampling distribution.

c) The mean of this sampling distribution is close to a common transcendental number. Describe how sampling could be used to create a greater certainty about this value?

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