CSCE235
Forum 3: Induction

March 2, 2009

Team Name: The Infinite Loop

Student Names: Colton Bailey

Jay Carlson

Cody Musilek

Solution: $\frac{7}{20}$

Grading: $\frac{2}{4}$

Use induction to prove that

$$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{n}{(n+1)!}=\boxed{1-\frac{1}{(n+1)!}}$$

for all $n \geq 1$.

✓ Base case: $n=1$

$$\frac{(1)}{((1)+1)!}=\frac{1}{2}=1-\frac{1}{((1)+1)!}=1-\frac{1}{2!}=1-\frac{1}{2}=\frac{1}{2}$$

✓ Thus, the base case is true by inspection. ✓

Induction step,

$$n=k:\ \frac{1}{2!}+\frac{2}{3!}+\cdots\frac{k}{(k+1)!}=1-\frac{1}{(k+1)!}$$

To prove?

$$n=k+1:\ \frac{1}{2!}+\frac{2}{3!}+\cdots\frac{(k+1)}{((k+1)+1)!}=1-\frac{1}{((k+1)+1)!}$$

$$\frac{1}{2!}+\frac{2}{3!}\cdots\frac{(k+1)}{((k+1)+1)!}=\frac{1}{2!}+\frac{2}{3!}+\cdots\frac{k}{(k+1)!}+\frac{(k+1)}{((k+1)+1)!}$$

$$=1-\frac{1}{(k+1)!}+\frac{(k+1)}{(k+2)!}$$

$$\overset{?}{=}1-\frac{1}{(k+2)!}+\frac{(k+1)}{(k+1)!}$$

$$=1-\frac{1}{(k+2)!}$$

$$1-\frac{k+1-k+2}{(k+2)!}$$

$$=\frac{\cdots-\cancel{k}+2}{(\cancel{k}+2)(k+1)}$$

QED

Conclusion? B −10. $\frac{-7}{20}$ −5 $\frac{15}{20}$

→ Grading forgot about the big conclusion & also summary of induction step.

Gabe + Anthony

CSCE235
Forum 3: Induction

March 2, 2009

Team Name: Discretion Lane.

Student Names: Jason Bland   Tim Ferguson

Solution: 4/20

Grading : ~~20~~ ~~10/10~~ 4/4

Use induction to prove that

$$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{n}{(n+1)!}=1-\frac{1}{(n+1)!}$$

for all $n \geq 1$.

Key mistake! -3

Induance.

Basis

+2 $n=1$

base case $\frac{1}{(1+1)!} = 1 - \frac{1}{(1+1)!}$

$\frac{1}{2!} = 1 - \frac{1}{2!}$

$\frac{1}{2} = 1 - \frac{1}{2}$

$\frac{1}{2} = \frac{1}{2}$

Conclusion? true by inspection?

$P(k) \to P(k+1)$

+3 $n=k$ $\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{k}{(k+1)!} = 1-\frac{1}{(k+1)!}$

induction step

$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{k}{(k+1)!}+\frac{(k+1)}{((k+1)+1)!}$

0/6 What is to be proven?

$= 1 - \frac{1}{(k+1)!} + \frac{(k+1)}{(k+2)!}$

4/8 need to finish algebraic proof

$= 1 - \frac{1}{(k+1)!} + \frac{k+1}{((k+1)+1)}$

0/2 no conclusion

- Not organized
- Not following steps

Missed!

I would have ~~put~~ given only $\frac{3}{20}$ or $\frac{4}{20}$.

9/20

Not too shabby!

— The Infinite Lagp

CSCE235
Forum 3: Induction

March 2, 2009

Grader: Discretions
Tim Ferguson
Jason Bland
20/20

Team Name: The Right Way

Student Names: Tay Way Loon

Tim Miller

Solution: $\frac{20}{20}$

grading: 4/4

Use induction to prove that

$$\frac{1}{2!} + \frac{2}{3!} + \cdots + \frac{n}{(n+1)!} = 1 - \frac{1}{(n+1)!}$$

for all $n \geq 1$.

Basis:

If $n = 1$

$$\frac{n}{(n+1)!} = \frac{1}{(1+1)!} = \frac{1}{2!} = \frac{1}{2} = 1 - \frac{1}{(1+1)!} = 1 - \frac{1}{2!} = 1 - \frac{1}{2} = \frac{1}{2}$$

Thus by inspection, we can see that the basis is true

Induction step:

We want to show that $P(k) \to P(k+1)$

$n = k$, $P(k)$: $\frac{1}{2!} + \frac{2}{3!} + \ldots + \frac{k}{(k+1)!} = 1 - \frac{1}{(k+1)!}$

$n = k+1$, $P(k+1)$: $\frac{1}{2!} + \frac{2}{3!} + \ldots + \frac{k+1}{((k+1)+1)!} = 1 - \frac{1}{((k+1)+1)!} = 1 - \frac{1}{(k+2)!}$

$$\frac{1}{2!} + \frac{2}{3!} + \ldots + \frac{k+1}{((k+1)+1)!} = \frac{1}{2!} + \frac{2}{3!} + \ldots \frac{k}{(k+1)!} + \frac{k+1}{((k+1)+1)!}$$

$$= P(k) + \frac{k+1}{((k+1)+1)!} = 1 - \frac{1}{(k+1)!} + \frac{k+1}{((k+1)+1)!} = 1 - \frac{1}{(k+1)!} + \frac{k+1}{(k+2)!}$$

$$= 1 - \frac{k+2}{(k+1)!(k+2)} + \frac{k+1}{(k+2)!} = 1 + \frac{-k-2+k+1}{(k+2)!}$$

$$= 1 - \frac{1}{(k+2)!}$$

thus we have shown that $P(k) \to P(k+1)$

by principle of mathematical induction

have shown

okay

CSCE235
Forum 3: Induction

March 2, 2009

Team Name: CIRCLE BEAR

Student Names: Josh Branchaud

Dan Wieshert

Paul Sanders.

Solution: $\frac{12}{20}$

grading: 4/4.

12/20

Graded by The Right Way

Use induction to prove that

$$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{n}{(n+1)!}=1-\frac{1}{(n+1)!}$$

for all $n \geq 1$.

Basis: $n = 1$

$$\frac{n}{(n+1)!}=\frac{1}{(1+1)!}=\frac{1}{2!}=\frac{1}{2}=1-\frac{1}{(n+1)!}=1-\frac{1}{(1+1)!}=1-\frac{1}{2!}=1-\frac{1}{2}=\frac{1}{2}$$

correct!

is true -1

We have shown the basis is true by inspection.

Induction: We want to show that $P(k) \rightarrow P(k+1)$

$P(k)$: $n=k$: $\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{k}{(k+1)!}=1-\frac{1}{(k+1)!}$

$P(k+1)$: $n=k+1$: $\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{(k+1)}{(k+2)!}=1-\frac{1}{(k+2)!}$

To prove: $\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{(k+1)}{(k+2)!}$

$$=\underbrace{\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{k}{(k+1)!}}+\frac{(k+1)}{(k+2)!}$$

$$=1-\frac{1}{(k+1)!}+\frac{(k+1)}{(k+2)!}$$

$$=1-\frac{(k+2)!}{(k+1)!(k+2)!}+\frac{(k+1)(k+1)!}{(k+1)!(k+2)!}$$

$$=1-\frac{(k+2)!+(k+1)(k+1)!}{(k+1)!(k+2)!}$$

$$=1-\frac{(k+1)!(k+2)+(k+1)(k+1)!}{(k+1)!(k+2)!}$$

$$=1-\frac{(k+1)!\left[(k+2)+(k+1)\right]}{(k+1)!(k+2)!}$$

$=1-$

$$=1-\frac{k+2}{(k+2)!}+\frac{(k+1)}{(k+2)!}$$

$$=1-\frac{2k+3}{(k+2)!}$$

-2

$$1+\frac{-k-2+k+1}{(k+2)!}$$

$$=1-\frac{1}{(k+2)!}$$

by math induction $P(k) \Rightarrow P(k+1)$ have shown is true

-5

fair grading

CSCE235
Forum 3: Induction

March 2, 2009

Team Name: Ramrod

Student Names: Branden Barber   Luke Vanderbeek

Solution: 6/20

Grading: 3/4

GRADED BY TEAM CIRCLEBEAR

$\frac{6}{20}$ fair score.

Use induction to prove that

$$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{n}{(n+1)!}=1-\frac{1}{(n+1)!}$$

for all $n \geq 1$.

(-1) Basis; $n=1$ $\quad \frac{1}{2!} = 1 - \frac{1}{(1+1)!}$

Inspection is done by stringing the equations together. Solve left side and then do right side.

Ex. $\frac{1}{(1-1)!} = \frac{1}{2!} = \frac{1}{2} = \frac{1}{(1+1)!} = \frac{1}{2!} = \frac{1}{2}$

good! $\quad \frac{1}{2} = 1 - \frac{1}{2!}$

$= \frac{1}{2} = \frac{1}{2}$

I would have put down -3 or -4.

We have shown that the basis at $n=1$ is true by inspection. Yes!

(-1) Confusing to use same variable as in original equation.

Induction; prove that $P(n) \rightarrow P(n+1)$ Try using K.

$P(K) \rightarrow P(K+1)$

Incorrect setup

$P(n): 1-\frac{1}{(n+1)!} = 1-\frac{1}{(n+1)!}$

$P(n+1): 1-\frac{1}{((n+1)+1)!} = 1-\frac{1}{(n+2)!}$

$P(K): n=K \quad \frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{K}{(K+1)!} = 1-\frac{1}{(K+1)!}$

$P(K+1): n=K+1 \quad \frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{K+1}{(K+2)!} = 1-\frac{1}{(K+2)!}$ (-2)

(-8) To prove: $P(K+1)$

I would have put down -4

(-5) $\sum_{n=1}^{K+1} 1-\frac{1}{(n+2)!} = \sum_{n=1}^{K} 1-\frac{1}{(n+1)!} + 1-\frac{1}{((n+1)-1)}$

incorrect setup

(-5) No conclusion

QED

\ by
Branden Burba
Luke Vanderbeek

CSCE235
Forum 3: Induction

March 2, 2009

Team Name: ______________________

Student Names: Anthony Foster   Gabe Williamson

Solution: $\frac{7}{20}$

Grading: $\frac{2}{4}$

10/20

I would have given this probably 7/10 or 6/10.

Use induction to prove that

$$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{n}{(n+1)!}=1-\frac{1}{(n+1)!}$$

for all $n \geq 1$.

Basis: $n=1$

$$\frac{1}{(1+1)!} = \frac{1}{2!} = \frac{1}{2} = 1-\frac{1}{(1+1)!} = 1-\frac{1}{2!} = 1-\frac{1}{2} = \frac{1}{2}$$

Thus we have shown that the basis is true by inspection.

Induction: We want to show $P(k) \rightarrow P(k+1)$.

$P(k)$: $n=k$ $\quad \frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{k}{(k+1)!} = 1-\frac{1}{(k+1)!}$

$P(k+1)$: $n=k+1$ $\quad \frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{(k+1)}{((k+1)+1)!} = 1-\frac{1}{((k+1)+1)!}$

Prove:

?

$$\frac{1}{2!}+\frac{2}{3!}+\cdots+\frac{k+1}{((k+1)+1)!} = \frac{1}{2!}+\frac{2}{3!}+\frac{k}{(k+1)!}+\frac{k+1}{((k+1)+1)!}$$

simplify completely -3

Conclusion? -7