(24) Marks total

Name:_____ Section: (day/time) _____

AMS5 - MIDTERM
Tuesday October 27th, 2009

A Normal Table is on the last page of this exam.

You must explain all answers and/or show working for full credit.

You are reminded of the University's policy on Academic Misconduct. Remember, if you are aware of a student committing academic misconduct, you are expected to bring it to the attention of the instructor.

1. My son's favorite board game is called "Going on a Bear Hunt" and is played with a spinner. The three sections of the spinner are colored yellow, red and blue. The yellow section is marked with the number '1', the red section with the number '2', and the blue section with the number '3'. When spun, the pointer has equal chance of landing on each of the three sections.

   The first three spots on the board, not including the starting spot, are red, yellow and blue (in that order). (After these three come many more spots of all the colors.) If you arrive on the blue spot, you take a card which determines what you do next.

   (a) When using the spinner, are color and number independent? (1)

   No. if event A is "spinner lands on yellow" and event B is "spinner land on number 1" the chance of event B depends strongly on event A having happened.

   (b) What is the chance of arriving at the first blue spot in *exactly* two spins? (1)

1st \ 2nd spin	R	Y	B
R			X
Y			X
B			

← these two outcomes result in landing on the first blue spot in exactly two spins

chance is $\frac{2}{9}$

   (c) If I'm playing the game with my two kids, what's the chance that all three of us will miss landing on the first blue spot? (2)

chance of landing on 1st blue spot = chance of landing there in 1 spin + chance of landing there in 2 spins + chance of landing there in 3 spins

$= \frac{1}{3} + \frac{2}{9} + \left(\frac{1}{3}\right)^3 = \frac{16}{27}$

(blue on 1st spin; see part (b); R then Y then B)

— these are mutually exclusive

chance of not landing on 1st blue spot $= 1 - \frac{16}{27}$

chance of all 3 of us not landing on 1st blue spot $= \left(1 - \frac{16}{27}\right)^3 = 0.067$

[TURN OVER]

2. A family has four children. Assuming that each child is a boy or a girl with equal chance, which of the following two breakdowns are more likely?

(2)

(a) 2 boys and 2 girls

(b) 3 of one sex, and one of the other

$$P(2 \text{ boys} + 2 \text{ girls}) = \frac{4!}{2!\,2!}(0.5)^2(0.5)^2 = \frac{3}{8}$$

$$P(3 \text{ of one sex, one of the other}) = P(3 \text{ boys} + 1 \text{ girl}) + P(1 \text{ boy} + 3 \text{ girls})$$

$$= 2 \times \frac{4!}{3!\,1!}(0.5)^3(0.5)^1 = \frac{1}{2}.$$

b) - is more likely.

3. At the end of this exam is the first page of a letter from UCSC Chancellor George R. Blumenthal to UC President Mark Yudof. This letter was part of a discussion about reducing the UC's budget shortfall by reducing expenditure on staff and faculty.

Read the section under the heading "Summary of Employee Comments".

(a) How many comments were received overall?

(1)

approximately 650 (300 + 350)

(b) How many respondents chose Option II? Explain your answer.

(1)

We do not know. The key phrase is

"of those who responded with a specific option selection..."

[TURN OVER]

4. Draws are being made at random with replacement from a box. The number of draws is getting larger and larger. Say whether each of the following statements is true or false, and explain. ("Converges" means "gets closer and closer".)

(a) The probability histogram for the sum of the draws (when put in standard units) converges to the normal curve. (1)

True. The central limit theorem says that the distribution of the sum of draws converges to the normal curve.

(b) The histogram for the numbers in the box (when put in standard units) converges to the normal curve. (1)

False - the histogram for the numbers in the box does not change, and depends on what is in the box - which may be far from the normal curve

(c) The histogram for the numbers drawn (when put in standard units) converges to the normal curve. (1)

False - the distribution of tickets in the box may be far from the normal curve, and the histogram of numbers drawn will converge to that distribution

(d) The probability histogram for the product of draws (when put in standard units) converges to the normal curve. (1)

False - it is the sum of draws converges to the normal curve.

(e) The histogram for the numbers drawn converges to the histogram for the numbers in the box. (1)

True - eventually the fluctuations in how many times each type of ticket is drawn will become relatively small, and the histograms will look alike

[TURN OVER]

1 − 0.0015	0.0015
200	−100,000

5. You might sell insurance to a 21 year old friend. The probability that a man aged 21 will die in the next year is about 0.0015. You decide to charge \$200 for a policy that will pay \$100,000 if your friend dies.

(a) What is your expected profit? (1)

average of box $200 \times (1-0.0015) + (-100{,}000) \times 0.0015$

$= 49.7$

expected profit \$49.70

(b) Although you expect to make a profit, you would be foolish to sell your friend this policy. Why? (1)

Because if he does die, you will be out a lot of money.

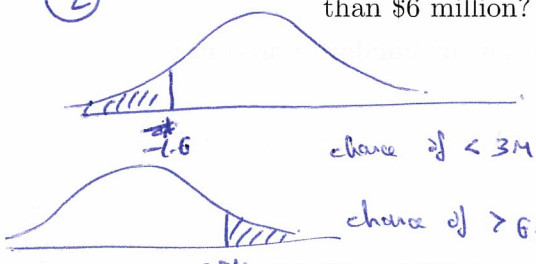
(c) An insurance company sells 100,000 such policies. They expect to make \$ 4.97M plus or minus \$ 1.23M (1)

expected value = # draws × ave of box = $100{,}000 \times 49.70 = \$4.97\text{M}$

SE = $\sqrt{\#\text{draws}} \times \text{SD box} = \sqrt{100{,}000} \times (200 - (-100000))\sqrt{(1-0.0015) \times 0.0015}$

$= 1.23$ M.

(d) What is the chance that the insurance company makes less than \$3 million? Greater than \$6 million? (2)



in standard units \$3M is $\frac{3-4.97}{1.23} = -1.6$

\$6M = $(6-4.97)/1.23 = 0.84$

chance of < 3M is $\frac{1}{2}(100-A)$ where A is the area  = 89 (from table)

$= 5.5\%$.

chance of > 6M = $\frac{1}{2}(100-A)$ where A is area  = 60 chance is 20%.

(e) The CEO's bonus is based on the company making more than \$6 million each year for a trailing 3-year period. What's the chance of the CEO not getting a bonus if the company sells 100,000 policies each year? (1)

CEO gets a bonus if profit > 6M for 3 years,

P(profit > 6M in a given year) = 0.2 (see part d)

P(gets a bonus) = 0.2^3

P(doesn't get bonus) = $1 - 0.2^3 = 0.992$.

[TURN OVER]

6. Read the news report "Daily Sweets 'linked to violence' " printed at the end of this exam paper.

(1)

(a) Was this a controlled experiment or an observational study? Explain briefly.

Observational study - they did not assign kids to sweets/no sweets groups.

(1)

(b) List three confounding factors that were considered.

parenting behaviour
location
education

(1)

(c) The article states that the link between confectionery consumption and aggression "remained, even after for controlling for other factors such as parenting behavior....". What does "controlling for" mean in this context?

when sub-groups that had the same parenting behaviour (for example) were looked at, the link was still present.

(1)

(d) The report says that the researchers looked at data on 17,500 people, and that 69% of the participants who were violent at the age of 34 had eaten sweets and chocolate nearly every day during childhood, compared to 42% who were non-violent.
How many people in the study were classed as violent?

we do not know. the % of the ~~pp~~ study participants who were classed as violent is not given.

(1)

(e) Does eating sweets daily as a child cause delinquency in adults? Explain briefly.

No. there is an association between daily sweets + delinquency.

[TURN OVER]

Page last updated at 23:16 GMT, Wednesday, 30 September 2009 00:16 UK

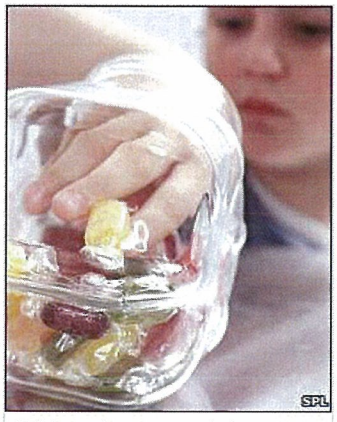
Daily sweets 'linked to violence'

Children who eat sweets and chocolate every day are more likely to be violent as adults, according to UK researchers.

The Cardiff University study involving 17,500 people is the first into effects of childhood diet on adult violence.

It found 10-year-olds who ate sweets daily were significantly more likely to have a violence conviction by age 34.

Researchers suggested they had not learnt to delay gratification, but other experts said already "difficult" children might be given more sweets.



Children who cannot wait for something they want may become aggressive

Could childhood sweet eating make you violent?

The researchers looked at data on around 17,500 people and found that 69% of the participants who were violent at the age of 34 had eaten sweets and chocolate nearly every day during childhood, compared to 42% who were non-violent.

Delinquents

This link between confectionery consumption and later aggression remained even after controlling for other factors such as parenting behaviour, the area where the child lived, not having educational qualifications after the age of 16 and whether they had access to a car when they were 34.

The researchers put forward several explanations for the link including the idea that the confectionery makes the adult addicted to certain additives and that these may contribute towards adult aggression.

> **"Targeting resources at improving children's diet may improve health and reduce aggression"**
>
> Dr Simon Moore, Cardiff University

The study was reported in the British Journal of Psychiatry.

Stunted learning

Dr Simon Moore, who led the study, has carried out previous research on young offenders.

He was aware that they tend to have very poor diets including lots of confectionery - but was intrigued to find the link.

He said: "Our favoured explanation is that giving children sweets and chocolate regularly may stop them learning how to wait to obtain something they want.

> **"This is either utter nonsense or a very bad April Fool's Day joke"**
>
> Julian Hunt
> Food and Drink Federation

"Not being able to defer gratification may push them towards more impulsive behaviour, which is strongly associated with delinquency.

"Targeting resources at improving children's diet may improve health and reduce aggression."

Professor Alan Maryon-Davis, president of the UK Faculty of Public Health, said: "Another explanation is that children who are already

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July 1, 2009

President Mark G. Yudof
Office of the President
University of California
1111 Franklin Street, 12th Floor
Oakland, CA 94607-5200

Via e-mail: president@ucop.edu

Dear Mark:

Re: Comments on Proposed Furlough/Salary Reduction Plan Options

Thank you for the opportunity to comment on the proposed Furlough/Salary Reduction Plan Options. The Santa Cruz campus solicited comments from Senate faculty, non-represented academic and staff employees, and managers and supervisors, and received over 650 comments in the brief turnaround time provided. While we received a wide variety of comments and suggestions, this letter articulates the most prevalent and key points expressed by the campus community. In addition, I have enclosed the comments received for your review and consideration.

As you will see in the following summary of comments, there were five specific areas in which both academic and staff employees articulated common viewpoints:

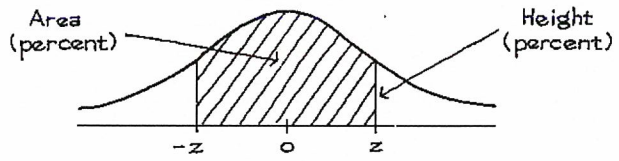
1) Option II was the preferred selection by an overwhelming margin;
2) Retirement, service credit, and leave accruals should not be negatively impacted;
3) Salary reductions should be graduated or progressive;
4) Specific sunset clause needed for whatever plan is chosen; and
5) Extramurally funded employees should not be included in any plan.

Summary of Employee Comments

We received over 300 comments from the academic members of the Santa Cruz campus, including comments from the Chair of the Santa Cruz Division of the Academic Senate and the Senate Committee on Planning and Budget. In addition, some 350 comments were received from our managers, supervisors and non-represented staff employees.

Of those who responded with a specific option selection, 84% of academic respondents and 88% of staff respondents chose Option II: 21 Unpaid Days Plan. The main reason conveyed by academics for this

Tables



A NORMAL TABLE

z	Height	Area	z	Height	Area	z	Height	Area
0.00	39.89	0	1.50	12.95	86.64	3.00	0.443	99.730
0.05	39.84	3.99	1.55	12.00	87.89	3.05	0.381	99.771
0.10	39.69	7.97	1.60	11.09	89.04	3.10	0.327	99.806
0.15	39.45	11.92	1.65	10.23	90.11	3.15	0.279	99.837
0.20	39.10	15.85	1.70	9.40	91.09	3.20	0.238	99.863
0.25	38.67	19.74	1.75	8.63	91.99	3.25	0.203	99.885
0.30	38.14	23.58	1.80	7.90	92.81	3.30	0.172	99.903
0.35	37.52	27.37	1.85	7.21	93.57	3.35	0.146	99.919
0.40	36.83	31.08	1.90	6.56	94.26	3.40	0.123	99.933
0.45	36.05	34.73	1.95	5.96	94.88	3.45	0.104	99.944
0.50	35.21	38.29	2.00	5.40	95.45	3.50	0.087	99.953
0.55	34.29	41.77	2.05	4.88	95.96	3.55	0.073	99.961
0.60	33.32	45.15	2.10	4.40	96.43	3.60	0.061	99.968
0.65	32.30	48.43	2.15	3.96	96.84	3.65	0.051	99.974
0.70	31.23	51.61	2.20	3.55	97.22	3.70	0.042	99.978
0.75	30.11	54.67	2.25	3.17	97.56	3.75	0.035	99.982
0.80	28.97	57.63	2.30	2.83	97.86	3.80	0.029	99.986
0.85	27.80	60.47	2.35	2.52	98.12	3.85	0.024	99.988
0.90	26.61	63.19	2.40	2.24	98.36	3.90	0.020	99.990
0.95	25.41	65.79	2.45	1.98	98.57	3.95	0.016	99.992
1.00	24.20	68.27	2.50	1.75	98.76	4.00	0.013	99.9937
1.05	22.99	70.63	2.55	1.54	98.92	4.05	0.011	99.9949
1.10	21.79	72.87	2.60	1.36	99.07	4.10	0.009	99.9959
1.15	20.59	74.99	2.65	1.19	99.20	4.15	0.007	99.9967
1.20	19.42	76.99	2.70	1.04	99.31	4.20	0.006	99.9973
1.25	18.26	78.87	2.75	0.91	99.40	4.25	0.005	99.9979
1.30	17.14	80.64	2.80	0.79	99.49	4.30	0.004	99.9983
1.35	16.04	82.30	2.85	9.69	99.56	4.35	0.003	99.9986
1.40	14.97	83.85	2.90	0.60	99.63	4.40	0.002	99.9989
1.45	13.94	85.29	2.95	0.51	99.68	4.45	0.002	99.9991