IMPORTANT - READ THIS!

Do NOT use this sample test as a study guide! Instead, study first, by re-reading your notes and the textbook, and re-working problems from homework and previous exams. Then, and only then, you may use these problems to test your knowledge. If you find that you are unsure about a problem (and/or get it wrong, and/or don't know how to do it at all), do ALL of the following:

1. Find out where you made a mistake,
2. Learn how to do the problem correctly,
3. Carefully read that entire section of the textbook and the relevant portions of your notes, since it is indicative of insufficient knowledge about that particular subject.

If instead you just learn how to do that problem correctly, then you're not helping yourself since that exact problem will not be on the actual exam. In short, you need to know *the material*, not simply how to solve these problems! If you need more problems to practice, there are plenty more in the textbook and in previous final exams for this course.

---

1. Consider the following expenses and incomes.

Job salary	\$2400 per month
Interest income	\$1200 per year
Mortgage	\$1000 per month
Food	\$50 per week
Car insurance	\$600 every 6 months
Property taxes	\$3000 per year

(i) What is this person's monthly income?
(ii) What are this person's total monthly expenses?
(iii) What is the net cash flow for this person?

---

2. Construct a truth table for the proposition p AND (NOT q).

---

3. Many smoke detectors contain a radioactive substance which has a half-life of about 400 years. If a smoke detector contains 1mg of this substance, how much will remain in 1200 years?

---

4. Consider propositions p, q and r with

$$\begin{aligned} p &= \text{true}, \\ q &= \text{false}, \\ r &= \text{true}. \end{aligned}$$

Find the truth values for each of the following:
(i) p AND q
(ii) p OR q
(iii) (NOT p) AND q
(iv) p XOR r

---

5. Consider the following argument:
Time is money. I have a lot of time. Therefore I have a lot of money.
Which of the following best describes this argument?
(A) Invalid argument.
(B) Valid but not sound argument.
(C) Valid and sound argument.
(D) Strong inductive argument.
(E) Weak inductive argument.

---

6. Consider the following conditional: "If you will vote for the bill then you are a patriot."
Which of the following is the contrapositive of this statement?

(A) If you do not vote for the bill then you are not a patriot.
(B) If you are a patriot then you will vote for the bill.
(C) If you are not a patriot then you will not vote for the bill.
(D) The statement is false, and therefore has no contrapositive.

---

7. 1 kilometer is about the same distance as 0.62 miles. If you're speedometer says you're going 80 km/h, approximately how fast are you going in miles per hour?
(A) 10 mph
(B) 120 mph
(C) 60 mph
(D) 100 mph
(E) 50 mph

---

8. Convert 68 degrees Fahrenheit to Celsius.

(A) 0 degrees
(B) 5 degrees
(C) 20 degrees
(D) 32 degrees
(E) 18 degrees.

---

9. If government spending on education in 2009 is 15% more than in 2008, which of the following is true?

(A) The spending in 2009 is 115% of the spending in 2008.
(B) Spending on education now accounts for at least 15% of the budget.
(C) The 2008 year's education spending was 90% of the 2009 spending.
(D) The reference value is the spending in the year 2009.

---

10. The CPI is useful because...
(A) It makes things cheaper for us now than they were in the past.
(B) It is used to fight inflation.
(C) It gives us a way to compare the buying power of currency from different years.
(D) The CPI is not useful.

---

11. I deposit \$1000 into an account paying interest at an APR of 20%, compounded twice per year. How much will I have one year later?

(A) \$1000
(B) \$1200
(C) \$1210
(D) \$1400
(E) \$1440

---

12. Suppose you invest \$500 dollars in an account with a 4% APR which compounds quarterly. How much money will you have in the account in 10 years.

(A) $\$500 + 40 \times 500 \times 0.04$
(B) $\$500 \times (1.01)^{40}$
(C) $\$500 + 500 \times (1.04)^{10}$
(D) $\$500 \times (1.04)^{10}$
(E) $\$500 \times (1.04)^{40}$.

---

13. Suppose you begin making payments of \$400 per quarter into an account paying interest at an APR of 6% compounded quarterly. How much will you have in 15 years?

(A) $\$400 \times 4 \times 15 + 400 \times 4 \times 15 \times 0.04$

(B) $\$400 \times \left(1 + \dfrac{0.04}{4}\right)^{60}$

(C) $\$400 \times \dfrac{\left[\left(1 + \frac{0.04}{12}\right)^{12\times 15} - 1\right]}{\left(\frac{0.04}{12}\right)}$

(D) $\$400 \times \dfrac{\left[\left(1 + \frac{0.04}{4}\right)^{60} - 1\right]}{\left(\frac{0.04}{4}\right)}$

(E) $\dfrac{\$400 \times \left(\frac{0.04}{4}\right)}{\left[1 - \left(1 + \frac{0.04}{4}\right)^{-60}\right]}$

---

14. If you take out a loan for \$150000 at an APR of 5%, compounded monthly, and pay it off with monthly payments over 20 years, what will the monthly payment be?

(A) $\dfrac{\$150000 \times \left(\frac{0.05}{12}\right)}{\left[1 - \left(1 + \frac{0.05}{12}\right)^{-240}\right]}$

(B) $\$150000 \times \dfrac{\left[\left(1 + \frac{0.05}{12}\right)^{240} - 1\right]}{\left(\frac{0.05}{12}\right)}$

(C) $\dfrac{\$150000 \times 0.05}{240}$

(D) $\$150000 \times \left(1 + \dfrac{0.05}{12}\right)^{240}$

(E) $\$150000 \times 0.05/12$

---

15. Consider the following exchange rates:

$$\begin{aligned} 1 \text{ USD} &= 2\ £ \\ 1.5 \text{ USD} &= 1\ €\end{aligned}$$

200€ is worth how much in sterling pounds (£)?

(A) 300 USD
(B) 400 £
(C) 100 £
(D) 600 £
(E) Cannot be determined from the given information.

---

16. Terry sets up a bank account with a deposit of $15,000 and makes no further deposits or withdrawals. The account pays interest compounded quarterly with an APR of 3.25%. How much will the account be worth in 20 years?

(A) $\$15000\left(1+\frac{0.0325}{12}\right)^{12\times 20}$.
(B) $\$15000\left(1+\frac{0.0325}{3}\right)^{3\times 20}$.
(C) $\$15000\left(1+\frac{0.0325}{4}\right)^{4\times 20}$.
(D) $\$15000+20\times 15000\times 0.0325$.
(E) $\$15000\left(1+0.0325\right)^{20}$.

---

17. A certain radioactive substance has a half-life of 1000 years. If something contained 10g of it 3000 years ago, how much would remain today?

(A) none.
(B) (10/3)g
(C) 4g
(D) 2g
(E) 1.25g

---

18. The populations of countries don't necessarily...

(A) grow.
(B) grow exponentially.
(C) behave in a way that's easy to predict.
(D) All of the above.

---

19. A certain population is currently 100000 and has a doubling time of 15 years. What will the population be t years from now?

(A) $100000t/15$
(B) $100000 \times 2^{t/15}$
(C) $100000 \times \left(\frac{1}{2}\right)^{t/15}$
(D) $100000 \times 2^{15 \times t}$
(E) $100000 \times 2 \times t$

---

20. Which of the following is **not** an example of a function?
(A) Assigning a unique social security number to each living US citizen.
(B) The weight of people as a function of their height.
(C) $y = 2x + 4$.
(D) All of the above.

---

21. An election has 3 candidates, A, B, and C. Consider the following preference schedule.

First	A	B	C	B
Second	B	C	B	A
Third	C	A	A	C
	14	6	5	5

Who wins if the election is decided by majority rule?

(A) Candidate A.
(B) Candidate B.
(C) Candidate C.
(D) No winner.

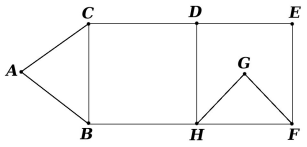
---

22. Use the preference schedule from the previous problem and determine the winner using a Borda count.

(A) Candidate A.
(B) Candidate B.
(C) Candidate C.
(D) No winner.

---

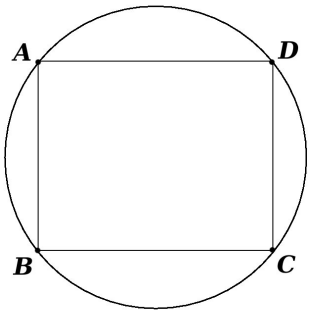
23. Find a Hamiltonian circuit in the following network.



(A) $H \to B \to C \to A \to B \to H \to D \to E \to F \to G \to H$
(B) $H \to G \to F \to E \to D \to C \to B \to H$
(C) $B \to H \to G \to F \to E \to D \to C \to A \to B$
(D) One does not exist.

---

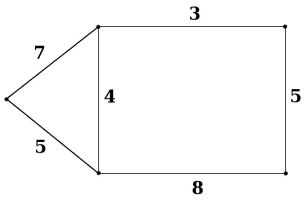
24. Does the following network have an Euler circuit?



(A) Yes, this graph has an Euler circuit.
(B) No, this graph has no Euler circuits.
(C) Cannot be determined from the given information.

---

25. The following network represents towns (vertices) and possible powerline connections (edges) together with the cost of each. What is the minimum cost required to connect the towns? (i.e., the cost of a minimum cost spanning network).



(A) 10
(B) 15
(C) 3
(D) 17
(E) 25

Formula sheet

Compound interest paid n times per year: $A = P\left(1 + \dfrac{\text{APR}}{n}\right)^{(nY)}$.

Savings plan formula (Regular payments): $A = \text{PMT} \times \dfrac{\left[\left(1 + \frac{\text{APR}}{n}\right)^{(nY)} - 1\right]}{\left(\frac{\text{APR}}{n}\right)}$.

Loan payment formula (installment loans): $\text{PMT} = \dfrac{P \times \left(\frac{\text{APR}}{n}\right)}{\left[1 - \left(1 + \frac{\text{APR}}{n}\right)^{(-nY)}\right]}$.

Convert from Celsius to Fahrenheit: $F = 1.8C + 32$.