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MID-SEMESTER EXAMINATION, December-2022
DIGITAL LOGIC DESIGN (EET1211)

Programme: B.Tech **Semester: 3rd**
Full Marks: 30 **Time: 2 Hours**

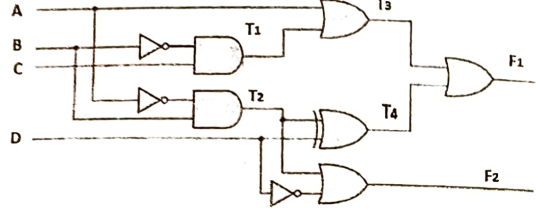
Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Able to State and explain different number systems, binary codes	L1	1	6
Able to apply the principles of Boolean algebra and Karnaugh map to simplify logic expressions and implement it using gates	L1,L2,L3	2	6
Able to Analyze and design various combinational circuits	L3,L4,L6	3,4,5	18

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) Convert the hexadecimal number 64CD to binary, and then convert it from binary to octal. 2
   (b) Perform subtraction on the given unsigned binary numbers using the 2's complement of the subtrahend. 2
   10011 - 10010
   (c) Represent the decimal number 6,248 in (a) BCD, (b) excess-3 code and (c) 2421 code. 2
2. (a) Simplify the following Boolean expression to a minimum number of literals: (BC'+ A'D) (AB'+ CD') 2
   (b) Implement the Boolean function F = xy + x'y' + y'z With NAND and inverter gates. 2
   (c) Simplify the following Boolean function F(x, y, z), together with the don't-care conditions d(x, y, z) using K-Map. 2
   $F(x, y, z)= \sum(0, 1, 4, 5, 6)$, $d(x, y, z)= \sum(2, 3, 7)$

3.



Consider the combinational circuit shown above.

(a) Derive the Boolean expressions for T_1 through T_4. Evaluate the outputs F_1 and F_2 as a function of the four inputs. 2

(b) List the truth table with 16 binary combinations of the four input variables. Then list the binary values for T_1 through T_4 and outputs F_1 and F_2 in the table. 2

(c) Write a Verilog dataflow model of the circuit. 2

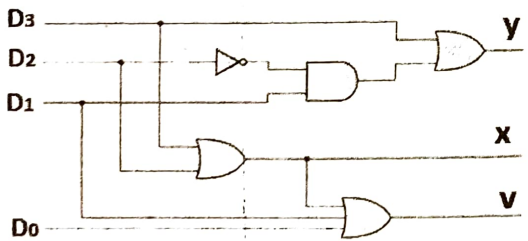
4. Design a combinational circuit that converts a four-bit Gray code to a four-bit binary number.

(a) Derive the Minimized Boolean expression for each output of the circuit. 2

(b) Draw the logic diagram for the circuit. 2

(c) Write a Verilog dataflow model of the circuit. 2

5. (a) 2



Write the HDL gate-level description of 4bit priority encoder circuit given above.

(b) Design a full- subtractor using 3 to 8 line decoder and external OR gates. 2

(c) Implement the following Boolean function with a multiplexer $F(A, B, C, D)=\sum(0, 3, 5, 7, 13, 14)$ 2

End of Questions

MID SEMESTER EXAMINATION, December-2022
Computer Science Workshop 1 (CSE2141)

Programme: BTech
Full Marks: 30

Semester: 3rd
Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Understand full stack development, web application development, and model view controller.	L1, L2	Q1	6
Understand and implement HTML, cascading style sheet (CSS), CSS configuration with HTML.	L1, L2, L3	Q2, Q3	6+6
Become acquainted with jQuery, Bootstrap, java syntax.	L1, L2, L3	Q4	6
Structuring Data with Java, Object-Oriented Techniques, Functional Programming Techniques.	L1, L2, L3	Q5	6
Understanding collection, error handling garbage collection, multi treading.	L1, L2, L3		
Become familiar with Spring framework, spring MVC, and hibernate.	L1, L2, L3		

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1	(a)	What is full stack web development? Write the technologies essential for full stack development.	2
	(b)	Describe model view controller architect with suitable example.	2
	(c)	What is simple object access protocol? Write its properties.	2
2.	(a)	Create a HTML page to display your personal profile as describe below: • Heading to display "My Personal Profile" with suitable background, and text color. • A table to display your educational qualifications. Table must be proper border, size, color.	2

	(b)	• A table to display your work experiences. Table must be proper border, size, color. • Create a list of your hobbies.	2
	(c)	• Passport size photo of yours must be present at the top right of the HTML page. • A paragraph about your self is present at the last of HTML page with proper background, and text color. Note: Write one script for the question number 2 all bits.	2
3.	(a)	Create an HIML page for register a new user for a website as instructed below. • HTML pages consist of a heading "New user registration" align middle, with text color other than default color, font is times new roman, font size is 100%. • Add a logo of the corresponding web align middle and with proper size.	2
	(b)	• Add label and text field for different data, such as first name, middle name, last name, username, email id, address. • Apply hover to each text field to change is color.	2
	(c)	• Add a drop-down to select current city of the user. • Add two buttons submit and clear. Note: Write one script for the question 3 all bits.	2
4.	(a)	Write a program to create a responsive HTML page having the following properties. • A dropdown menu with three option All, Best Sellers, Mobile. Each option has at least two dropdown list.	2
	(b)	Add some images of items in the body of the HTML page. Add a color animated progress bar to the html page	2
	(c)	Add a pagination at the last of the HTML page. Note: Write one script for the question 3 all bits.	2
5.	(a)	Write a java program to reverse the i^{th} and j^{th} bit of a 64-bit integer.	2
	(b)	Write a java program to delete the duplicate numbers in a sorted array.	2
	(c)	Write a java program to find the reverse of each word of a sentence and check is there any palindromic word is present or not.	2
		End of Questions	

MID-SEMESTER EXAMINATION, DECEMBER - 2022
PROBABILITY & STATISTICS (MTH - 2002)

Programme : B.Tech
Full mark: 30

Semester : 3rd
Time: 2 Hours

Subject Learning Outcome	*Taxonomy Level	Ques. No.	Marks
Apply probability axioms to compute probability and conditional probability	L1, L2, L3, L4	1(a,b) 2(a)	2*3
Define random variables and compute probability distributions.	L4, L4, L4,	3(b,c)	2*2
joint & marginal distribution	L1, L4, L4	4(a)	2*1
Compute expectation of random variables	L5, L4,	3.(a) 5(a,b,c)	2*4
Discuss discrete probability distribution.	L3, L4	2(b)4(b)	2*2
Binomial, Hypergeometric & negative Binomial.	L4	4(c)	2*1
Estimate the variance	L4	1(c), 2(c)	2*2

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5).

Answer all questions. Each question carries equal mark.

1.(a) An experiment consists of tossing a die and then flipping a coin once if the number on the die is even. If the number on the die is odd, the coin is flipped twice. Describe the sample space using tree diagram. 2

(b) The probability that an American industry will locate in Shanghai is 0.7, the probability that it will locate in Beijing is 0.4 and the probability that it will locate in either Shanghai or Beijing or both is 0.8. Compute the probability that the industry will locate 2

(i) In both cities.
(ii) In neither city.

(c) In a certain assembly plant, three machines B_1, B_2 *and* B_3 make 30%, 20% and 50%, respectively, of the products. It is known from past experience that 2%, 3% and 3% of the products made by each machine, respectively, are defective. Now, suppose that a finished product is randomly selected and found to be defective, calculate the probability that it was made by machine B_1 2

2.(a) The waiting time, in hours, between successive speeders spotted by a radar unit is a continuous random variable with cumulative distribution function 2

$$F(x)=\begin{cases}0, & x<0\\ 1-e^{-8x}, & x\geq 0\end{cases}$$

(i) Compute the probability density function of X.
(ii) Find the probability of waiting less than 12 minutes between successive speeders.

(b) For a laboratory assignment, if the equipment is working, the density function of the observed outcome X is 2

$$f(x)=\begin{cases}2(1-x), & 0<x<1\\ 0, & otherwise\end{cases}$$

Compute the mean and variance of X.

(c) A random variable X has a mean $\mu = 0$ and variance $\sigma^2 = 4$. Using Chebyshev's theorem, find P (- 4 < x < 4). 2

3.(a) A traffic control engineer reports that 75% of the vehicles passing through a checkpoint are from within the state. Compute the probability that fewer than 4 of the next 9 vehicles are from out of state. 2

(b) The probabilities are 0.4, 0.2, 0.3 and 0.1 respectively, that a delegate to a certain convention arrived by air, bus, automobile, or train. Compute the probability that among 9 delegates randomly selected at this convention, 3 arrived by air, 3 arrived by bus, 1 arrived by automobile, and 2 arrived by train. 2

(c) Evaluate the value of 'k' for which f(x) given below will be a valid Probability function 2

$f(x)=k\,x^2,\ x=0,1,2,3.$

4 (a) Suppose X and Y have the following joint probability function 2

f(x,y)		x		
		0	1	2
y	1	0.1	0.1	0.2
	3	0.2	0.1	0.15
	5	0.15	0	0

Estimate $P(Y\leq 3 \mid X=1)$.

(b) Let X and Y denote the lengths of life, in years, of two components in an electronic system. If the joint density function of these variables is

$$f(x,y)=\begin{cases}x+y, & 0<x<1,\ 0<y<1\\ 0, & elsewhere\end{cases}$$

Compute marginal distribution of X and Y.

(c) Calculate the expected number of tails when a fair coin is tossed twice. 2

5.(a) From a certain manufacturing process, it is known that on the average 1 in every 10 items is defective. Calculate the Probability that the fifth item inspected is the 2nd defective item found. 2

(b) The average number of field mice per acre in a 5-acre wheat field is estimated to be 12. Compute the probability that fewer than 7 field mice are found on a given acre. 2

(c) If 5 books are picked at random from a shelf containing 7 mathematics, 3 physics and 2 chemistry books, calculate the probability that 2 mathematics books are selected.

End of Questions

Answer all questions. Each question carries equal mark.

1. (a) Prove by mathematical induction that the sum of the cubes of three successive natural numbers is divisible by 9. 2

(b) The conjecture $f(n) = O(g(n))$ implies $2^{f(n)} = O(2^{g(n)})$, is true or false? Justify your answer with a suitable example or counter-example. 2

(c) Write a pseudocode to compute "p multiplied by q" as "q times repeated addition of p" using recursion. 2

2. (a) Solve the following recurrence using recursion tree method and give an asymptotic bound for Z(x), where $Z(x) \leq Z(x/3) + k$
(k is any positive real constant) 2

(b) Check the correctness of the following algorithm. 2

```
guess(A, n) /* A is an array of n integers */
  i = 0
  while i < n - 1 do
      if A[i] > A[i+1]
            swap(A[i], A[i+1])
      i = i + 1
  return A[n-1]
```

(c) 2

```
fun(int x)
{ if(x==1)
      return 1;
  else {
      fun(x/3);
      fun(x/3);
      fun(x/3);
      for k ← 1 to x do
            n ← n + 1; }
}
```

Find the time and space complexity of the given algorithm.

3. (a) Which, if any, of the algorithms bubble-sort, heap-sort, merge-sort, and quick-sort are stable? 2

(b) Assuming that all elements are distinct in a binary max-heap, where might the smallest element be present? Justify your answer with proper reason. 2

(c) After illustrating the operation EXTRACT_MAX(A) three times on the binary max-heap A(27,17,3,16,13,10,1,5,7,12,4,8,9,0), what is the updated array? 2

4. (a) Give a critcal comparison of Kruskal's algorithm and Prim's algorithm to generate a minimum spanning tree. 2

(b) Design an efficient algorithm using DFS to check whether or not there exists a cyclic path in a directed graph. 2

(c) Given an undirected graph G = (V, E), where V = {a, b, c, d, e, f, g, h, i, j} and the edges of E are processed in the order {(d,i), (c,j), (f,h), (b,g), (h,i), (e,b), (f,d)} to compute the the number of connected components using UNION-FIND data sturcures. Then how many times is FIND-SET() called and how many times is UNION() called? Express your answers in terms of |V|, |E|, and the number of connected components k. 2

5. (a) Give an example set of 10 characters and their associated frequencies so that, in the Huffman tree for this set, every internal node has an external-node child. 2

(b) Given a set of intervals S = {(3,5), (5,9), (6, 10), (0,6), (3,8), (1,4), (8,11), (4,7)}, find an optimal schedule of the mutual compatible intervals using "fewest conflicts first" greedy-choice-property. Check the optimality of the solution obtained. 2

(c) Given a set of n objects and distance $d(p_i, p_j)$ between the distinct objects p_i and p_j, if the objects are related to each other directly. Design a *nlogn* based greedy algorithm to partition the n objects into m clusters, where objects in the same cluster are very close to each other. (Hint: First, formulate the given problem as a connected, weighted graph) 2

*** End of Questions ***

MID-SEMESTER EXAMINATION, DECEMBER-2022
Principles of Macroeconomics (HSS2021)

Programme: B. Tech **Semester: 3rd**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Interdependence and gain from trade	L1, L2, L3	1	6
Measuring nation's income	L1, L2, L3	2	6
Measuring the cost of living	L1, L2, L3	3	6
Production & Growth	L1, L2, L3	4	6
Saving, Investment and Financial System	L1, L2, L3	5	6

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1.	(a)	Suppose that in a year an American worker can produce 100 shirts or 20 computers, while a Chinese worker can produce 100 shirts or 10 computers. Graph the production possibilities curve for the two countries. Suppose that without trade the workers in each country spend half their time producing each good. Identify this point in your graph.	2
	(b)	If these countries were open to trade, which country would export shirts? Give a specific numerical example and show it on your graph. Which country would benefit from trade? Explain.	2
	(c)	Explain at what price of computers (in terms of shirts) the two countries might trade?	2
2.	(a)	Below some data are given on milk & butter	2

Year	Price of Milk	Quantity of Milk	Price of Butter	Quantity of Butter
2015	$ 8	100 (quarts)	$ 16	50 (quarts)
2016	$ 12	200	$ 20	100
2017	$ 16	200	$ 24	100

Compute the nominal GDP, real GDP & GDP deflator for each year using 2015 as base year

	(b)	Compute percentage change in nominal GDP, real GDP & GDP deflator in 2016 & 2017 from the preceding year	2
	(c)	Determine the inflation rate in the year 2016 & 2017.	2
3.	(a)	How the consumer price index is calculated?	2
	(b)	What are the problems arise in measuring the cost of living.	2
	(c)	What is the percentage change in price of each of the three goods & compute the percentage change in the overall price level.	2

		Tennis Balls	Foot Balls	Basket Balls
2015	Price	$ 10	$ 20	$ 30
2015	Quantity	100	200	300
2016	Price	$ 15	$ 25	$ 35
2016	Quantity	100	200	300

4.	(a)	Define productivity. What are the determinants of productivity?	2
	(b)	Why would removing a trade restriction such as tariff, lead to more rapid economic growth.	2
	(c)	Explain the catch-up effect through the help of a diagram.	2
5.	(a)	What do you mean by financial market? Explain the difference between bond market & stock market.	2
	(b)	What is the role of financial intermediaries?	2
	(c)	Suppose GDP is Rs. 80 lakhs, taxes are Rs. 8 lakhs, public saving is Rs. 4 lakhs, private saving is Rs. 6 lakhs. Assuming this economy is closed, calculate consumption, government purchases, national saving, and investment.	2
		End of Questions	