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6. a) Write the output that will be shown if the *Index.html* in Figure 4 below is run in a browser. Replace "**YOUR_STUDENT_ID**" in test.js with your IUT student ID. You do not need to show the step-by-step procedure. The final output is sufficient. 10 (CO2) (PO2)

Index.html

```
<!DOCTYPE html>
<head>
  <meta charset="UTF-8">
  <title>Test</title>
</head>
<body>
  <div id="para"></div>
  <script src="test.js"/>
</body>
</html>
```

test.js

```
const sid = YOUR_STUDENT_ID % 5;

const Display = (number) => {
  let c;
  let val = 1;
  let output = "";
  for(c=0; c < number; c++){
     val += val;
     output += "<p>" + val + "</p>";
  }
  (1==="1")?
    (c=val+20+"$px") : (c=val+7+"$qx")
    output += "<h1>"+ c +"</h1>";
    return output;
}

let value = Display(sid);
       para.innerHTML = value;
```

Figure 4: Code snippet for Question 6.a)

b) Use the flexbox CSS property to create the layout given in Figure 5 below. 10 (CO5) (PO2)

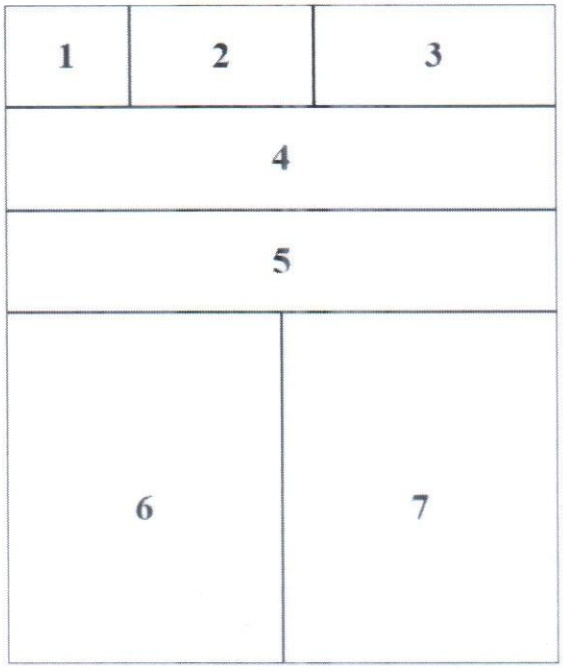

Figure 5: Flex box layout for Question 6.b)

c) Describe the different types of navigation used in cross-platform mobile application development. 5 (CO3) (PO1)

B.Sc. in (SWE) 6th Semester 05 April 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER: FINAL EXAMINATION **SUMMER SEMESTER, 2020-2021**
DURATION: 3 HOURS **FULL MARKS: 150**

Math 4643: Probability and Statistics II

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **any 6 (six)** questions. Marks of each question and corresponding CO and PO are written in the right margin.

---

1. a) Define normal distribution and standard normal distribution in terms of their respective probability density functions. 4 (CO1) (PO1)

   b) i. Show that the area under the normal curve having a probability density function is unity. 9 (CO2)
   ii. Find the mean and variance of the standard normal distribution. (PO2)

   c) i. The normal random variable Y having a mean 25 and unknown variance is distributed in such a way that $P(Y < 30) = 0.6915$. Find the variance of Y. 12 (CO3)
   ii. The line width while manufacturing semiconductor is assumed to be normally distributed with a mean of 0.5 micrometer and variance of 0.0025 micrometer. Now, what is the probability that the line width is greater than 0.64 micrometer? Also, find the probability that the line width is between 0.48 and 0.65 micrometer. (PO3)

2. a) Define Poisson distribution. Prove that the Poisson distribution function is a probability mass function. 6 (CO1) (PO1)

   b) Find the mean and variance of Poisson distribution. 7 (CO2) (PO2)

   c) If the average number of claims handled daily by an insurance company is 6, then what is the probability that the company will receive 12 (CO3) (PO3)
   i. no claim?
   ii. exactly two claims?
   iii. at least three claims on Friday?

3. a) Define statistical hypothesis with two examples. Classify the types of statistical hypothesis. 6 (CO1) (PO1)

   b) What do you mean by power of a test? Define the level of significance and comment on what level of significance is statistically accepted in hypothesis testing. 6 (CO2) (PO2)

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c) The daily production of milk in a diary firm has an average of 880 tons for the last couple of months. The authority would like to know whether this average has changed or not in recent time. For investigating the fact they selected 50 days randomly from their database and found that the average and standard deviation of the 50 days' production were 870 tons and 22 tons, respectively. If 5% level of significance is considered, then compute the power of the test and hence sketch the power curve. 13 (CO3) (PO3)

4. a) i. Define type-I and type-II error using their mathematical expression. Define critical region, and hence mention their role in statistical hypothesis testing. 7 (CO1) (PO1)

ii. What do you mean by confidence interval? Write down the mathematical formulation for finding out the confidence interval for a two-tailed test.

b) What do you mean by power of a test? Define the level of significance and comment on what level of significance is statistically accepted in hypothesis testing? 6 (CO2) (PO2)

c) i. The mean and variance of CGPA scores obtained from a random sample of 50 students of IUT were found to be 2.8 and 0.1225, respectively. Would it be logical to conclude that the sample has come from the entire group of students which has a mean score of 2.4? Use 5% level of significance and compute 95% confidence interval for the mean score in the population. 12 (CO3) (PO3)

ii. The sample data show that 120 adults males born in rural areas have a mean height of 62.7 inches with a standard deviation of 2.50 inches, and that of 150 males who born in urban areas have 61.8 inches and 2.62 inches, respectively. Using 1% level of significance, test the hypothesis that the mean heights in the two different areas from where the samples have been taken do not differ.

5. a) i. What do you mean by correlation in statistical science? Write down the classification of correlation between two random variables. 12 (CO1) (PO1)

ii. Define covariance and correlation coefficient of two random variables with their mathematical representations.

b) Consider the joint probability density function of two random variables X and Y as follows: 7 (CO3) (PO3)

$$f(x,y) = \begin{cases} \frac{6}{5}(x^2 + 2xy); if\ 0 \le x \le 1, 0 \le y \le 1 \\ 0; otherwise \end{cases}$$

Find the covariance between the two random variables. Compute the correlation by means of correlation coefficient.

c) Three girls A, B, and C share the household works. Since A is the oldest, she does the job 40% of the time, while B and C share the other 60% equally. The probability that at least one dish will be broken when A is working is 0.02; for B and C, the probabilities are 0.03 and 0.04, respectively. The parents do not know who is washing the dishes, but one morning they hear one dish has been broken. What is the probability that B was working on that morning? 6 (CO3) (PO3)

6. a) i. Define probability density function for a random variable and write down its properties. 10 (CO1)

ii. Define cumulative distribution function for a discrete random variable with its mathematical representation. (PO1)

b) A continuous random variable X has the following density function: 8 (CO2) (PO2)

$$f(x) = \begin{cases} \frac{1}{30}(x^2 - 2x + 4); 2 \leq x \leq 5 \\ 0; otherwise \end{cases}$$

i. Verify that it satisfies the condition $\int_{-\infty}^{\infty} f(x)dx = 1$

ii. Evaluate $P(X < 3)$.

iii. Find the value of $P(3 < X < 4)$.

c) A fair coin is tossed three times. If X is the random variable representing the number of tails obtained, then find the probability distribution function of X and hence find its cumulative distribution function (CDF). Also, sketch the CDF of X and comment on the nature of this distribution. 7 (CO3) (PO3)

7. a) What do you mean by nonparametric hypothesis testing? Under what condition, a nonparametric hypothesis testing could be applied? 6 (CO1) (PO1)

b) If a sample of size 200 contains 120 values that are less than m_0 and 80 values that are greater, what is the p-value of the test of the hypothesis that the median is equal to m_0? 7 (CO2) (PO2)

c) In a study of bilingual coding, 12 bilingual (French and English) college students are divided into two groups. Each group reads an article written in French, and each answers a series of 25 multiple-choice questions covering the content of the article. For one group the questions are written in French, the other takes the examination in English. The score (total correct) for the two group is: 6 (CO3) (PO3)

Exam in French	11	12	16	22	25	25
Exam in English	10	13	17	19	21	24

Is this evidence at the 5% level of significance that there is difficulty in transforming information from one language to another?

d) In a certain region, insurance data indicate that 82% of the drivers have no accidents in a year, 15% have exactly 1 accident, and 3% have 2 or more accidents. In a random sample of 440 engineers, 366 had no accidents, 68 had exactly 1 accident, and 6 had 2 or more. Can you conclude that engineers follow an accident profile that is different from the rest of the drivers in the region? 6 (CO3) (PO3)

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8. a) The life of a particular type of generator is thought to be influenced by the material used in its construction and also by the temperature at the location where it is utilized. The following table represents lifetime data on 24 generators made from three different types of materials and used in two different temperatures. Do the data indicate that the material and temperature do indeed affect the lifetime of a generator? Is there evidence of an interaction effect? 8 (CO2) (PO2)

Material	Temperature	
	10^0 C	18^0 C
1	135, 150 176, 85	50, 55 64, 38
2	150, 162 171, 120	76, 88 91, 57
3	138, 111 140, 106	68, 60 74, 51

b) The following data refer to the number of deaths per 10,000 adults in a large Eastern city in the different seasons for the year 1982 to 1986. 9 (CO3) (PO3)

Year	Winter	Spring	Summer	Fall
1982	33.6	31.4	29.8	32.1
1983	32.5	30.1	28.5	29.9
1984	35.3	33.2	29.5	28.7
1985	34.4	28.6	33.9	30.1
1986	37.3	34.1	28.5	29.4

i. Assuming a two-factor model, estimate the parameters.

ii. Test the hypothesis that death rates do not depend on the season, using 5% level of significance.

c) A purification process for a chemical involves passing it, in solution, through a resin on which impurities are adsorbed. A chemical engineer wishing to test the efficiency of 3 different resins took a chemical solution and broke it into 15 batches. She tested each resin 5 times and then measured the concentration of impurities after passing through the resins. Her data were as follows: 8 (CO3) (PO3)

Concentration of Impurities		
Resin I	Resin II	Resin III
0.046	0.038	0.031
0.025	0.035	0.042
0.014	0.031	0.020
0.017	0.022	0.018
0.043	0.012	0.039

Test the hypothesis that there is no difference in the efficiency of the resins.

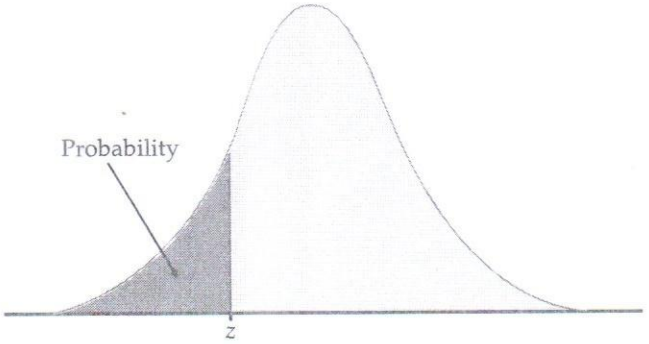

Table entry for z is the area under the standard normal curve to the left of z.

TABLE A

Standard normal probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Table entry for z is the area under the standard normal curve to the left of z.

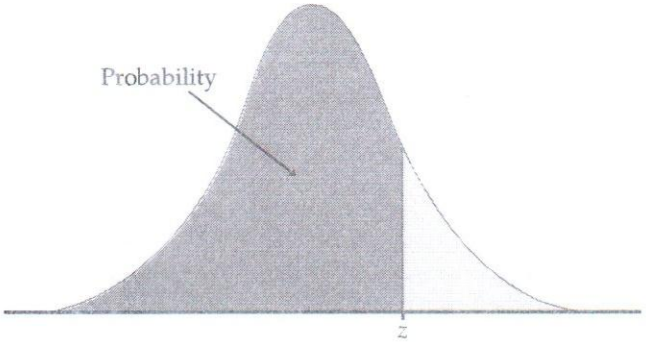

TABLE A

Standard normal probabilities (continued)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

B.Sc. in SWE 8th Semester — 4th April 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION — **SUMMER SEMESTER, 2020-2021**

DURATION: 3 HOURS — **FULL MARKS: 150**

SWE 4801: Software Maintenance

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 6 (Six)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

---

1. A pharmaceutical company wants to analyze their current legacy software. They have given this task to "ABC" software company. "ABC" software company analyzed the maintainability of the legacy software using software metrics.

   a) According to ISO 9126, what is maintainable software? Write all the characteristics of a maintainable software with their metrics (at least 3). — 5 (CO1) (PO1)

   b) What do you understand about software measurement? What are the objectives to measure a software? — 5 (CO1) (PO1)

   c) Explain, as a maintainer of "ABC" software company, how and what you will use to measure the **code-based artifacts** of the software system. — 15 (CO2) (PO2)

2. From Question 1, "ABC" software company suggested that existing software can be used for another 10 years. In regards to that, the Pharmaceutical company requested some new features and modifying existing ones. Before and during the implementation, "ABC" software wants to analyze the areas that will be affected by change.

   a) Elaborate how you will conduct impact analysis on the legacy software with a figure. Explain with an example how you will evaluate adequacy and effectiveness of any change made on the legacy software. — 4+6 (CO4) (PO2)

   b) L1 : int i = 0; — 5 (CO3) (PO1)
   L2 : do{
   L3 : assert (i <= 15);
   L4 : i = i + 5;
   L5 : }while(i <= 11);
   Draw a Program Dependency Graph of the above code fragment..

   c) For a given execution trace: ABCrDrrEFGHrrDrrrrx — 5 (CO4) (PO3)
   In the trace, r and x represent function returns and program exits, respectively. If procedure E is modified, find the potentially impacted procedures.

   d) For analyzing impact in a given source code it was found that. — 1+2+2 (CO3) (PO1)
   SIS={A,B}
   CIS={A,B,D,E}
   DIS={F,G,P,Q}
   AIS={A,B,F,G,P,Q}
   i. Find the false positive impact set.
   ii. Find error in impact estimation
   iii. Find the precision and recall

3 From Question 2, After implementing changes, the software maintainer wants to restructure the code so that it becomes maintainable. So, developers refactored the existing code so that it is maintainable.

a) What activities will you conduct as a developer to refactor the code? 10 (CO1) (PO1)

b) Calculate Crv, Cpp and Csv and Cy for the following Scenario. 3+3+3 +6 (CO2) (PO2)
For a function A,
Functions Q, R and Y are in the same class and others are in different class.
For methods m outside the class Krv(m) is 3, Kpp(m)=5, Ksv(m)=7

i. Set of functions provided return values to and used by function A={P(2),Q(4),R(1),S(2)}
ii. set of methods where return value of A is used and methods that called A ={X (3),Y(3)}
iii. Set of methods that shared instance variables with A ={P(3),Q(2),Y(4)}

Given Wrv=.2 and Wpp=.15 and Wsv=.65

4. From Question 3, After implementing changes, the software of the pharmaceutical company is sent to Software Quality Assurance team. The Quality assurance team found a requested feature was not modified by the development team. While investigating the cause, developer could not handle the complex code and its relationship with other features as it may break down the core services provided by the program.

a) What type of testing "ABC" software company will conduct? Write the different types of this testing and how these are conducted. 5 (CO1) (PO1)

b) Elaborate how you will conduct this testing as a member of Software Quality Assurance team member of "ABC" software Company. 10 (CO4) (PO2)

c) Since, the mentioned feature **could not be modified due complexity** of the source code in the **legacy software system.** So, as a developer of "ABC" software, what solution will you adopt to get service the feature? How will you construct the solution and adapt legacy software with it? 2+4+4 (CO3) (PO3)

5. After several years, the software of the pharmaceutical company could no longer be supported either by wrapping or redevelopment as there is a major technological change. So, "ABC" software company was given the responsibility to handle this case.

a) What is the best possible solution that "ABC" software can give regarding this case? Explain step by step about how they will carry it out. 5 (CO2) (PO2)

b) How will you plan the solution to handle this case? 15 (CO2) (PO3)

c) If "ABC" software company has adopted the "Composite Database" method, then how will they implement the solution? Explain with figures. 5 (CO3) (PO1)

6. "ABC" software company wants to make clear guidelines for its software maintenance process. In this regard, they are talking with the senior developers about how they conduct the maintenance.

a) Elaborate on how the maintenance framework of the company can effectively play role in Maintenance process. 15 (CO1) (PO1)

b) Senior developers mentioned about following phase model while they re-engineer software systems. Explain how they carry out reengineering activities following this model. 10 (CO1) (PO2)

B.Sc. in SWE 8th Semester 11 April 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2020-2021**

DURATION: 3 HOURS **FULL MARKS: 150**

SWE 4803: Software Project Management

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 6 (six)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

---

1. a) Identify and explain the important characteristics of software development projects which make them harder to manage compared to other types of projects. 8 (CO1) (PO2)

   b) Why software development houses prefer to use project organization over functional organization? How the project manager differs from functional or operational manager? 5+4 (CO1) (PO1)

   c) General Electric (GE) has the opportunity to invest in 2 projects. Project A requires an investment of $1000000 which will give a return of $300000 each year for 5 years. Project B requires an investment of $750000 which will give a return of $100000, $150000, $200000, $250000, and $ 250000 for the next 5 years. In which project GE should invest if the discount rate is 7%? 8 (CO1) (PO11)

2. a) **Table 1:** Table for Question 2. (a) 10+ 2+5 (CO3) (PO2)

Project Activity	Precedence Activity	Duration (Weeks)		
		Optimistic	Most likely	Pessimistic
Start		0	0	0
C	Start	2	3	4
D	C	2	7	9
A	C	5	7	12
E	D	1	3	8
B	A, E	4	5	6
F	E	2	3	4
End	B, F	0	0	0

   i. Estimate the duration and standard deviation of each task provided in Table 1 using PERT (beta distribution).
   ii. What is the estimated total duration of the project according to PERT?
   iii. What should be the safe statement to the sponsors about the estimation of project duration?

   b) "Lag provides mandatory delay to the Successor Activity and Lead provides acceleration to the Successor Activity" – justify with proper example. 8 (CO3) (PO2)

3. a) While creating the agenda of a common status meeting for two different projects, one of the team member mentions a very specific item that should be added in the meeting agenda. One of the project managers says that "We cannot deal with this item now!" Few other team members say that the team is not ready to resolve the item during the meeting. But after having a discussion with both the project teams, another project manager decides to put the item on the agenda as an initial discussion item. What sort of conflict resolution techniques are the project managers utilizing in the given scenario? 5 (CO3) (PO2)

b) CSE Department of IUT is planning to organize an App development contest on the last Friday of July 2022. You are selected as a project manager for this big event. You are allowed to start working on this project from 1st week of May 2022. Develop a project charter for your project. 15 (CO3) (PO3)

c) A company is making an effort to improve its project performance and create historical records of past projects. What is the best way to accomplish this? 5 (CO3) (PO2)

4. a) You want to let your team know that the weekly project status report is now officially due by 4:00 PM on each Thursday. Which type of communication would you use? 5 (CO3) (PO2)

b) A project manager for a large bank is in-charge of developing a new certificate of deposit product, which needs IT system development. His internal IT staff does not have expertise in the technology needed for this project. So, he must contract out the work. Unfortunately, he does not have the time to develop a detailed procurement statement of work, but this effort is likely to be large. In this situation, what is the best contract type the project manager should select? 8 (CO3) (PO4)

c) Formulate with your own example how the earned value chart depicts scheduled progress, actual cost, and actual progress (earned value) to allow the determination of cost, schedule, and time variances. 12 (CO3) (PO3)

5. a) For your upcoming project, you decided to develop 80 functionalities of your product within 5 days by some third-party Software development firm. The plan for 5 days and the actual development till day 3 is given in Table 2. Also, it is estimated that development cost for each functionality will be 1000$. And as a project manager you are performing monitoring and control activities on day 3. 6+4 (CO3) (PO2)

Table 2: Table for Question 5. (a)

	Day 1	Day 2	Day 3	Day 4	Day 5
Functionalities planned to be built	10	13	17	20	20
Functionalities actually built	8	12	16		
Actual cost for the day	8000	12000	16000		

i. Based on the given information analyze the impact of SV, CV, SPI, and CPI on your project.

ii. As the third-party organization failed to deliver the expected outcome, you decided to revise the budget of this project as 78000$. Calculate the TCPI for this change.

b) In one of the outsourced software development contractual agreements, the buyer and seller agreed to a cost of $300,000 and a profit/fee of $30,000. The buyer has informed that the ceiling price will be $360,000. Beyond the target cost, the sharing ratio between the buyer and seller will be 60:40. What is the PTA? 8 (CO3) (PO2)

c) Does profit/fee become zero at PTA? Justify your answer with proper example. 7 (CO3) (PO2)

6. a) As a project manager you need to decide whether to invest $120M to build a new data center, or to invest only $50M to upgrade the existing data center. If you decide to build a new one, then there is 60% chance that the new data center will help to generate revenue of $200M and 40% chance of generating revenue of $90M. Also, if you decide to upgrade the existing data center then there is 60% chance that it will help to generate revenue of $120M and 40% chance of generating revenue of $60M. Using proper data analysis method make your decision for the given scenario. 12 (CO4) (PO4)

b) "Designing redundancy into a system may reduce the impact from a failure of the original component." – What kind of strategy is this for dealing with risk? 5 (CO4) (PO2)

c) If the team cannot identify a suitable response to an identified risk, which risk response strategy would they apply? Justify your answer. 8 (CO4) (PO2)

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B.Sc. in SWE 8th Semester **13 April 2022**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER: 2020-2021**
DURATION: 3 HOURS **Full Marks: 150**

SWE 4805: SOFTWARE VERIFICATION AND VALIDATION

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 6 (six)** questions. Marks of each question and corresponding CO and PO are written in the brackets of the right margin.

---

1. a) Define Software Verification and Validation. Describe the activities of verification and validation of the V-model. 10 (CO1, PO1)

   b) It is difficult to generate test cases for integration testing. On the other hand, mutation testing is a technique to evaluate the effectiveness of test cases. How can we use mutation testing to perform integration testing effectively? 5 (CO1, PO1)

   c) Analyze the following myths of formal method and propose corresponding facts: 5+5 (CO1, PO2)
      i. Formal methods are all about program proving.
      ii. Formal methods delay the development process.

2. Consider the code snippet and answer the following questions:

```
int greatestNumber(int a, int b, int c) {
    int result = a;
    if(a > b && a > c) result = a;
    else if(b > c) result = b;
    else result = c;
    return result;
}
```

   a) Write a test plan having five (5) test cases considering boundary value analysis? In your test plan, only consider the input and its corresponding expected output. 5 (CO1, PO3)

   b) Create three types of mutants considering the above code snippet and calculate the mutation score using your test plan. 10 (CO2, PO3)

   c) Mutation testing takes a lot of time to execute. How can we speed up mutation testing? Give your opinion and explain with examples that can be explored in the future. 10 (CO2, PO2)

3. a) What is model-based testing? How do we perform it? 5 (CO1, PO1)

   b) Describe the differences between *smoke* and *sanity testing*, with their strengths and weaknesses? Explain with examples, when do you prefer one over another? 10 (CO1, PO1)

   c) Explain different types of performance testing. How to make the performance testing 10

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more effective? Give your opinion. (CO3, PO2)

4. Consider the code snippet and answer the following questions:

```
int inDegree(int graph[][], int vertex, int node) {
    int cnt = 0;
    for(int i=0; i<vertex; i++) {
        if(graph[i][node] == 1) cnt++;
    }
    return cnt;
}

int outDegree(int graph[][], int vertex, int node) {
    int cnt = 0;
    for(int i=0; i<vertex; i++) {
        if(graph[node][i] == 1) cnt++;
    }
    return cnt;
}

bool isDirected(int graph[][], int vertex) {
    for (int i = 0; i < vertex; i++) {
        if(inDegree(graph, vertex, i) != outDegree(graph,
           vertex, i)) return true;
    }
    return false;
}

int main() {
    //Assume, number of verteces, edges and adjacency matrix
    //of a graph are provided by the readInput() function
    int vertex, edge, graph[][] = readInput();
    if(isDirected(graph, vertex) == true)
        cout<<"Directed graph."<<endl;
    else
        cout<<"Undirected graph"<<endl;
    return 0;
}
```

a) What is integration testing? Write different approaches of integration testing, and what approach do you prefer and why? 8 (CO2, PO1)

b) What will be the structure of stubs and drivers considering `isDirected` function? 7 (CO1, PO1)

c) If the four functions (components) are spread across multiple computers (or other computing devices) on a network, how will you perform integration testing? 10 (CO2, PO2)

6. Consider the SRS and answer the following questions in Alloy.
We are building a permission management system. There are three kinds of things in it: **Accounts**, **Resources,** and **Users**.
-***resources*** and ***users*** belong to **Accounts**.
-**Users** can have direct access to ***resources***.
-A **Resource** can have a parent ***resource***.

a) Define **signatures** and ***fields***. 5 (CO1, PO1)

b) Write the following constraints in Alloy as fact: 2×5 (CO2, PO1)
   i. For every user, there is exactly one account.
   ii. For every resource, if there is a parent resource, both resources belong to one same account.
   iii. Every resource has an account.
   iv. A resource cannot be found from its ancestor.
   v. User should not have access to another account's resources.

c) Verify and validate every statement in Alloy as an assertion: 2×5 (CO2, PO2)
   i. No two users have the same set of resources.
   ii. Every resource belongs to exactly one account.
   iii. There is no common resource for two different accounts.
   iv. If a User can access a parent Resource, then s/he gets access to any child Resource.
   v. What does Alloy Analyzer do when we run the command `run {} for 5 but exactly 3 Account`?

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5. Consider the following Alloy code and answer the subsequent questions.

```
abstract sig Program {
            required: some Course
}
one sig CSE extends Program {}
one sig SWE extends Program {}
sig Course {
            enrolled: some Student,
            prerequisite: set Course
}
sig Student {
            id: one ID,
            batch: one Batch,
            program: one Program,
            transcript: set Course
}
sig RecordBook {
            students: set Student
}
sig ID, Batch {}
```

a) Describe the above code snippet in natural language. 5 (CO1, PO1)

b) Explain the following facts in natural language: 2×5 (CO2, PO1)

i. fact { all s: Student | let p: s.program | (p in CSE => p not in SWE) and (p in SWE => p not in CSE) }
ii. fact { CSE.required != SWE.required }
iii. fact { all s: Student | s.transcript.^prerequisite in s.transcript }
iv. fact { all disj s1,s2: Student | s1.program != s2.program => s1.transcript != s2.transcript }
v. fact { all s: Student, r: RecordBook | s in r.students => s.program.required in s.transcript }

c) Analyze the following assertions: 2×5 (CO2, PO2)

i. assert {no disj s1, s2: Student | s1.id != s2.id}
ii. assert {some c: Course | #c.enrolled.program =2}
iii. assert {some c: Course | c in CSE.required and c in SWE.required}
iv. assert { some c: Course, disj s1, s2: c.enrolled | s1.batch = s2.batch and s1.program != s2.program }
v. What does Alloy Analyzer do when we check an assertion with a specific scope?

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B.Sc. Engg. CSE / SWE 8th Semester 01 April 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2020-2021**

DURATION: 3 Hours **FULL MARKS: 100**

CSE 4809: Algorithm Engineering

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **6 (six)** questions. Answer **all** of them. Figures in the right margin indicate marks.

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1. a) Prove that the expected running time of a randomized select algorithm is ***O(n)***. 5 (CO5) (PO2)

   b) Prove that the expected number of comparisons in a randomized quicksort is ***nlgn***. 5 (CO5) (PO2)

   c) Prove that randomized MAX-3-CNF algorithm is an ***8/7 -approximation*** algorithm. 6 (CO5) (PO2)

2. a) i. Knowing Hamiltonian Circuit problem is NPC, confirm TSP problem is also NPC. 3x2 (CO3) (PO1)
      ii. Name two decision problems and two optimization problems that are NPC.
      iii. iii. Why are we interested in approximation algorithms?

   b) Proof that 2-CNF SAT is in P. 5 (CO3) (PO1)

   c) Write the approximation algorithm for TSP problem using Triangle inequality. 5 (CO3) (PO1)

3. a) i. What is a balanced tree? Write two applications of balanced tree. 4x2 (CO4) (PO1, PO2)
      ii. Why memory based balanced tree could not be used in disk based searching/indexing?
      iii. How does Red-Black Tree maintain the balance in the tree?
      iv. How does B-Tree maintain the balance in the tree?

   b) Prove that the maximum height of a B-Tree is $log_t (n+1)/2$, where t is the minimum degree and n is the total number of keys. 4 (CO4) (PO2)

   c) Insert the following keys in a B-tree (assume t is 3): 8 (CO4) (PO1)
      G M P X A C D E J K N O R S T U V Y Z B Q L F

4.	a)	i.	Greedy and Dynamic Programming are applied to problems with similar properties; what are those properties?	3x2 (CO2) (PO1, PO2)
		ii.	How does Johnson's algorithm use Dijkstra Algorithm to solve all pair shortest path?	
		iii.	Can Johnson's Algorithm solve shortest path problem with negative loops in the graph? Explain your answer.	
	b)		Write an algorithm to solve the fractional knapsack problem in $O(n)$ time.	5 (CO2) (PO2)
	c)		Write the optimal substructure property of Optimal Prefix Coding problem. What is the greedy heuristic applied by Huffman Coding Algorithm to find the optimal prefix coding?	5 (CO2) (PO2)
5.	a)	i.	What is the greedy heuristic for Dijkstra Algorithm? Why does the heuristic work?	3x2 (CO2) (PO1, PO2)
		ii.	What is the greedy heuristic for Activity Selection problem? Why does the heuristic work?	
		iii.	What is the graph property that Bellman Algorithm exploit? Is it a greedy or a dynamic programming algorithm?	
	b)		What do you understand by topological sorting? What is the role of topological sorting in finding shortest paths in DAG?	5 (CO2) (PO1)
	c)		Suppose there are cells in a rectangular mining field. Each cell may contain gold as reward, or may have bug that reduces the reward earned. We want to find the minimum number of squares in the mining field that will provide the maximum possible reward. Devise an algorithm or pseudo code for the purpose using greedy or dynamic programming technique.	5 (CO2) (PO3)
6.	a)	i.	Write two possible applications of Block Chain other than its use in crypto-currency.	3x2 (CO4) (PO1. PO2)
		ii.	What are the applications of Merkle Tree?	
		iii.	How can block chain be hacked?	
	b)		How is double spending restricted in a Block Chain-based crypto-currency?	5 (CO4) (PO1)
	c)		Explain the role of mining in Block Chain-based crypto-currency. How is the Proof of Work (PoW) ensured?	5 (CO4) (PO2)

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B.Sc. Engg. SWE 8th Semester	06 April 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION	SUMMER SEMESTER, 2020-2021
DURATION: 3 HOURS	FULL MARKS: 150

SWE 4833: UI/UX Interface Design

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 6 (six)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

---

1. a) What are design systems? Why do design teams need them? 5 (CO1) (PO1)

   b) Material is a design system by Google for user interface design. Taking Material and the other widespread design systems as reference, discuss the major components of a design system. 10 (CO1) (PO1)

   c) When Uber added more features resulting in a more complex product, users were often selecting the wrong feature. Then the company underwent their most recent redesign and focused on minimizing complexity in their interface. A before-and-after look at their primary screen is given in Figure 1. 10 (CO3) (PO2)

Figure 1

What may have been the rationale behind this change? How has the redesign made the app more intuitive and user-friendly?

2. a) Iconography has become one of the most visually appealing elements of graphic design. Describe how the Gestalt's Principle of continuity is used in some digital and non-digital icon designs. 10 (CO2) (PO1)

   b) How do components, modules and templates differ from each other? Explain with an example. 10 (CO1) (PO1)

   c) Construct the user flow of a task management software. 5 (CO2) (PO3)

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3.	a)	Explain the 60-30-10 rule with an example.	10 (CO2) (PO1)
	b)	Ideate on how typography can shape UI design.	5 (CO2) (PO1)
	c)	Discuss the effects of leading space and tracking space on readability of the interface.	6 (CO2) (PO1)
	d)	How is font different from typeface?	4 (CO1) (PO1)
4.	a)	What are the benefits of sketching a user journey?	5 (CO1) (PO1)
	b)	Design a closeup storyboard of a user visiting an ecommerce website for the first time.	10 (CO2) (PO3)
	c)	Describe some ways to resolve edge cases in a user journey.	10 (CO1) (PO1)
5.	a)	Define information architecture.	2 (CO1) (PO1)
	b)	Outline the core benefit of wireframing before designing a prototype.	3 (CO1) (PO1)
	c)	What are the differences between wireframes and mockups?	5 (CO1) (PO1)
	d)	Through wireframing, the design team and stakeholders can see which entities, pages, and components the application is going to have and how these elements will interact with each other. Sketch a wireframe design for a news portal targeted towards graduating university students. The goal of the design is to keep user retention high and increase engagement.	15 (CO3) (PO3)
6.	a)	List the common types of pain points faced by users.	2 (CO1) (PO1)
	b)	When the Amazon team tested their interface in India, it turned out that people in India associated the magnifying glass icon (search icon) with a ping-pong paddle and not with the 'Search' functionality. Suggest design changes in the interface that can solve this issue.	5 (CO2) (PO2)
	c)	Figure 2 shows the homepage of a website for "Khan's Kitchen" restaurant. It has been observed from a usability study that the conversion rate of users is very low. Describe how the homepage may be redesigned to boost conversion and keep users interested in the product.	10 (CO2) (PO3)

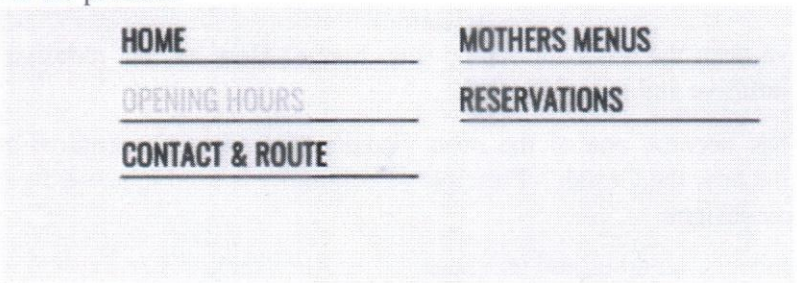

Figure 2

	d)	Create two personas for the restaurant homepage given in question 6(c). (Images are not required for the creation of these personas).	8 (CO2) (PO3)

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B.Sc. in SWE 8th Semester 28 March, 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SEMESTER: FINAL EXAMINATION **SUMMER SEMESTER, 2020-2021**

DURATION: 3 HOURS **FULL MARKS: 150**

SWE 4839: Big Data Analysis

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer all **6 (six)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

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1. We want to create a video-sharing website where registered users can upload, search, watch and share videos. They can also rate a video and post comments. However, despite watching lots of videos from the site, most of the users barely rate any videos or post any comments.
   Our goal is to design a recommender system based on collaborative filtering for the users of the site.

   a) First, we need to create a Utility Matrix. Recommend three possible solutions for gathering the "known ratings" for the matrix and discuss their pros and cons. **6×3 (CO3) (PO2)**

   b) There are two options to incorporate the local effects. We can take the average of rating deviations weighted by either the similarity of items/users or a set of weights learned from the data. Which option would you choose? Justify your choice by providing three reasons. **$1 + 2 \times 3$ (CO3) (PO2)**

2. In the web graph shown in Figure 1, each node corresponds to one web page. A directed edge from a node is considered as out-link, and to a node is considered as in-link.

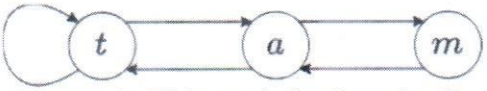

Figure 1: Web graph for Question 2.

   Suppose a search engine returns these three web pages for the search query "cricket". Assume that the search engine uses the Flow Model to calculate the PageRank.

   a) Using Power Iteration, determine the order in which the web pages will be shown. You have to show at least 4 iterations. **21 (CO1) (PO1)**

   b) Asses the consequence to the Flow Model if the out-link from m to a is removed. Propose a solution to alleviate the problem. **$2 + 2$ (CO3) (PO2)**

3. a) In order to perform dimensionality reduction, we need to determine the axes of data that reduce dimensions. Recommend policies that can be followed to choose the axes. **6 (CO1) (PO1)**

   b) In Singular Value Decomposition, we decompose the data matrix A into $U\Sigma V^T$. Show that U can be determined by calculating the eigenvector of $A^T A$. **19 (CO1) (PO1)**

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4. Table 1 shows a Utility Matrix, R for 6 movies $(M_1, M_2, \ldots, M_6)$ rated by 12 users $(U_1, U_2, \ldots, U_{12})$. Here, the value in cell R_{ij} denotes the rating for movie M_i provided by user $U_j (1 \leq i \leq 6; 1 \leq j \leq 12)$. An empty cell denotes that the movie has not been rated by the user yet.

Table 1. Utility Matrix, R for Question 1.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
M_1	1		3		?	5			5		4	
M_2			5	4			4			2	1	3
M_3	2	4		1	2		3		4	3	5	
M_4		2	4		5			4			2	
M_5			4	3	4	2					2	5
M_6	1		3		3			2			4	

We want to predict the rating of movie M_1 by user U_5 (denoted by '?' symbol).

a) Calculate the rating using vanilla Item-Item Collaborative Filtering. Assume that we will work with at most 2 neighbors and use Pearson's Correlation Coefficient as the similarity metric. **13 (CO1) (PO1)**

b) Calculate the rating again, but this time incorporate the baseline estimate with Item-Item Collaborative Filtering. If required, you can re-use any values and/or assumptions from Question 4.(a). **12 (CO1) (PO1)**

5. A company owns a search engine called "BackRub" and a video-sharing website called "MePipe". To process a search query, first, they enlist the web pages containing the query words. Then they order the web pages based on the number of times the query words appear on the web page.

a) Criticize the company's policy in handling the search queries by discussing two possible exploits that can be used by web spammers to make target web pages appear on top of the search results. **3 × 2 (CO3) (PO2)**

b) Recommend a solution that can be adopted by the company to counter these exploits. **9 (CO3) (PO2)**

c) Suppose that the company has adopted your solution. However, when people search for video-sharing sites, the company wants MePipe to be shown among the top results. Modify your recommended solution to achieve that. **10 (CO3) (PO2)**

6. a) Suppose we have information about the supermarket purchases of 100 million people. Each person goes to the supermarket 100 times a year and buys 10 of the 1000 items that the supermarket sells. We believe that a pair of "evil-doers" will buy exactly the same set of 10 items (perhaps the ingredients for a bomb?) at some time during the year. Is it worthwhile to search for people who are truly "evil-doers"? Justify your answer. **10 (CO3) (PO2)**

b) Consider the following schema for an SQL database: **15 (CO2) (PO3)**
Employee*(ID, Name, Designation, Salary)*
We want to determine the maximum salary for each designation.
Design a MapReduce system to execute the query.

Formulae that you might find useful:

- Pearson Correlation Coefficient, $\text{sim}(x, y) = \frac{\sum_{s \in S_{xy}} (r_{xs} - \overline{r_x})(r_{ys} - \overline{r_y})}{\sqrt{\sum_{s \in S_{xy}} (r_{xs} - \overline{r_x})^2} \sqrt{\sum_{s \in S_{xy}} (r_{ys} - \overline{r_y})^2}}$
- Predicted rating for item i of user x, $r_{xi} = \frac{1}{k} \sum_{y \in N} \text{sim}(x, y) \cdot r_{xj}$
- Predicted rating for item i of user x incorporating baseline estimate, $r_{xi} = b_{xi} + \frac{1}{k} \sum_{y \in N} \text{sim}(x, y) \cdot (r_{xj} - b_{xj})$
- Baseline estimate: $b_{xi} = \mu + b_x + b_i$
- Flow equation: $r_j = \sum_{i \to j} \frac{r_i}{d_i}$
- PageRank equation (The Google Formulation): $r_j = \sum_{i \to j} \beta \frac{r_i}{d_i} + (1 - \beta) \frac{1}{N}$
- Topic-Specific PageRank: $r_j = \begin{cases} \beta \frac{r_i}{d_i} + (1 - \beta) \frac{1}{|S|}, & if\ i \in S \\ \beta \frac{r_i}{d_i}, & otherwise \end{cases}$

B.Sc. in SWE 8th Semester 28 March 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2020-2021**

DURATION: 3 HOURS **FULL MARKS: 150**

CSE 4849: Human Computer Interaction

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 6 (six)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

Based on the following scenario and story, answer question number 1, 2, 3 and 4.

Restaurant 'Seasonal Platter' is a special kind of restaurant. During different seasons, like summer, winter or fall, they offer different types of specialty dishes. A special software is used to offer the dishes to the *customers for their choice*. At the end of the season, the customers who have an account with the restaurant can upvote or downvote the dishes, which would then affect the dishes of the later seasons. Dishes are actually *offered by the chefs themselves*, since they are responsible for offering their own specialty. A *manager oversees the whole process* and can modify, update or remove a dish offered by any chef.

Upon interviewing a famous chef, Mr. Rordon Gamsey from 'Seasonal Platter', a description of the overall process of offering a new dish was found and is attached below.

"Yeah, I remember the whole process. It is a bit tedious, but nothing too complex. First you need to log in with your chef account. Once there, you can offer new dishes. But before you offer, first you got to check whether your dish already exists or not. Like my Pineapple Smoothie is an all season favorite and it is there, always. So I do not need to re-offer it every time. However they did not like my Chicken Pot Pie last season, so it got removed from the display automatically by the system. I am offering it this season again though, since I believe it deserves a second chance. Since it was already offered once before, I just need to put it in the display using a single click, nothing an old chef cannot handle. I am also offering Chocolate Naga Cake this season, a completely new recipe. For this one though, I first need to create a new dish, put the name and the list of all the ingredients etc. Like you know, people have personal preferences, right? Once the dish is created, I can offer it to the whole world by a single click."

The owner of 'Season Platter' has decided to integrate an interactive display in each of the tables of the restaurant so that the customers can easily browse the dishes, order and register themselves and give their feedback. He has also decided to put the systems in the kitchen so that the chefs can fully utilize their eureka moments while inventing new dishes and register them right away.

1. a) With respect to the scenario, extract 3 requirements for each of the following cases that could have been used to build the system. Give a 1 or 2 line justification for each of them. 5□3=15 (CO4) (PO2)
   i. Functional Requirements
   ii. Data Requirements
   iii. Environmental Requirements
   iv. User Requirements
   v. Usability Requirements

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b) Based on the user story written above, create a Hierarchical Task Analysis with Plans and Graphs for *offering a new/existing dish by a chef.* **10 (CO4) (PO2)**

2. a) Briefly elaborate on two data gathering methods that you would find suitable in the above context if you were asked to implement the system from scratch. For each of the methods, explain how the specific method's advantage is going to fit the system and how the disadvantage needs to be overcome. **2□4=8 (CO4) (PO2)**

b) What are the different personas that can be taken into consideration while designing the aforementioned system based on the three roles, customers, chef and manager? Mention 6 personas with just their abilities or shortcomings with respect to the system in 2-3 sentences. You can choose your own distribution of persona under each role, for instance, 3 personas under customers, 2 under chefs and 1 under manager etc. **6□2=12 (CO4) (PO2)**

c) Can the process of affinitization help the development of the aforementioned system? Give proper reasoning behind your answer within 10 simple sentences. **5 (CO4) (PO2)**

3. a) Different prototyping techniques are suitable for different tasks. For instance, the above story can be represented using storyboarding or a series of sketches. Now, for the following tasks, mention a suitable prototyping method with 3 sentences explaining each why they are suitable. **3□3=9 (CO5) (PO2)**

i. Creating UI for the chefs for offering recipe
ii. Describing the interaction sequence of voting to the users
iii. Taking feedback from the users on the system

b) Represent a chef offering a new dish using storyboarding. The drawings need not be very good, but clear and understandable drawings are required. **10 (CO5) (PO2)**

c) Explain the sentence, "Though prototyping might prove to be costly in the initial phase, it may save valuable time and resources in the long run". **6 (CO1) (PO1)**

4. a) With respect to the scenario and aforementioned questions, illustrate how the Star Model can facilitate a user centric design process. **5 (CO3) (PO2)**

b) Suppose the owner of the restaurant wants to find an answer to the research question, "Does the color of the customer's UI influence the purchase decision and amount of a specific type of food (appetizer, main course and/or dessert)?". With respect to the research question, **5+10+5 =20 (CO5) (PO2)**

i. Describe an experiment with steps that may facilitate the answer to the question.
ii. Formally construct the independent, dependent, control, random and confounding variables of the experiment.
iii. Choose and justify a proper evaluation approach for the experiment.

5. Suppose you want to design a command line application for a certain task. The application has upto 30 configurable parameters. In your current design, the user may pass the value of each of the arguments or parameters while calling it from the terminal. Though 'help' can be called to list down all the possible parameters, novice users still find it difficult to properly use the application. And in many cases, for a certain user or environment, a lot of the parameters remain the same. For the simplicity of understanding, invocation of a command line tool, *gcc* for compiling a single C file is given below.

```
$ gcc Filename.c -o Application
```

The program takes 3 arguments, first one being the file name to compile, then '-o' to indicate that the next argument would be output file name/path and then accordingly, the output file name. Now based on this scenario, answer the following questions.

a) Point out how human memory, both short term and long term, can affect the usability of the aforementioned application. **8** **(CO2)** **(PO2)**

b) Propose an ideal solution (a single one based on your decision) to the problem of having 30 parameters in the aforementioned program. You cannot decrease the number of parameters **9** **(CO2)** **(PO2)**

c) Exemplify how the characteristics of reading text of human beings should influence the design of terminals and the output of command line programs. **8** **(CO2)** **(PO2)**

6. a) Based on your understanding from the classes, define what HCI is and where it is used under 15 simple sentences. **10** **(CO1)** **(PO1)**

b) Note down and describe at least 3 domains that you think contributed in making this question paper. It was written in Google Docs. Each domain description should not exceed more than 5 simple sentences. **8** **(CO1)** **(PO1)**

c) Define interface metaphors and how they influence the design of user interface in computer science under 7 sentences. **7** **(CO1)** **(PO1)**