UNIVERSITI SAINS MALAYSIA

Peperiksaan Kursus Semasa Cuti Panjang
Sidang Akademik 2003/2004

April 2004

ZCT 535/4 - Nuclear Medicine and Radiotherapy Physics
[Perubatan Nuklear dan Fizik Radioterapi]

Masa : 3 jam

Please check that the examination paper consists of **EIGHT** pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

Instruction: Answer all **SIX (6)** questions. Students are allowed to answer all questions in Bahasa Malaysia or in English.

*[**Arahan**: Jawab kesemua **ENAM (6)** soalan. Pelajar dibenarkan menjawab semua soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

1. (a) Describe what is meant by the terms: 'output', 'central axis percentage depth dose' and 'penumbra' in relation to megavoltage (MV) Xray.

[(a) Huraikan maksud ungkapan: 'output', 'peratus dos kedalaman pusat' dan 'penumbra' berhubung dengan megavoltan (MV) sinar-X.]

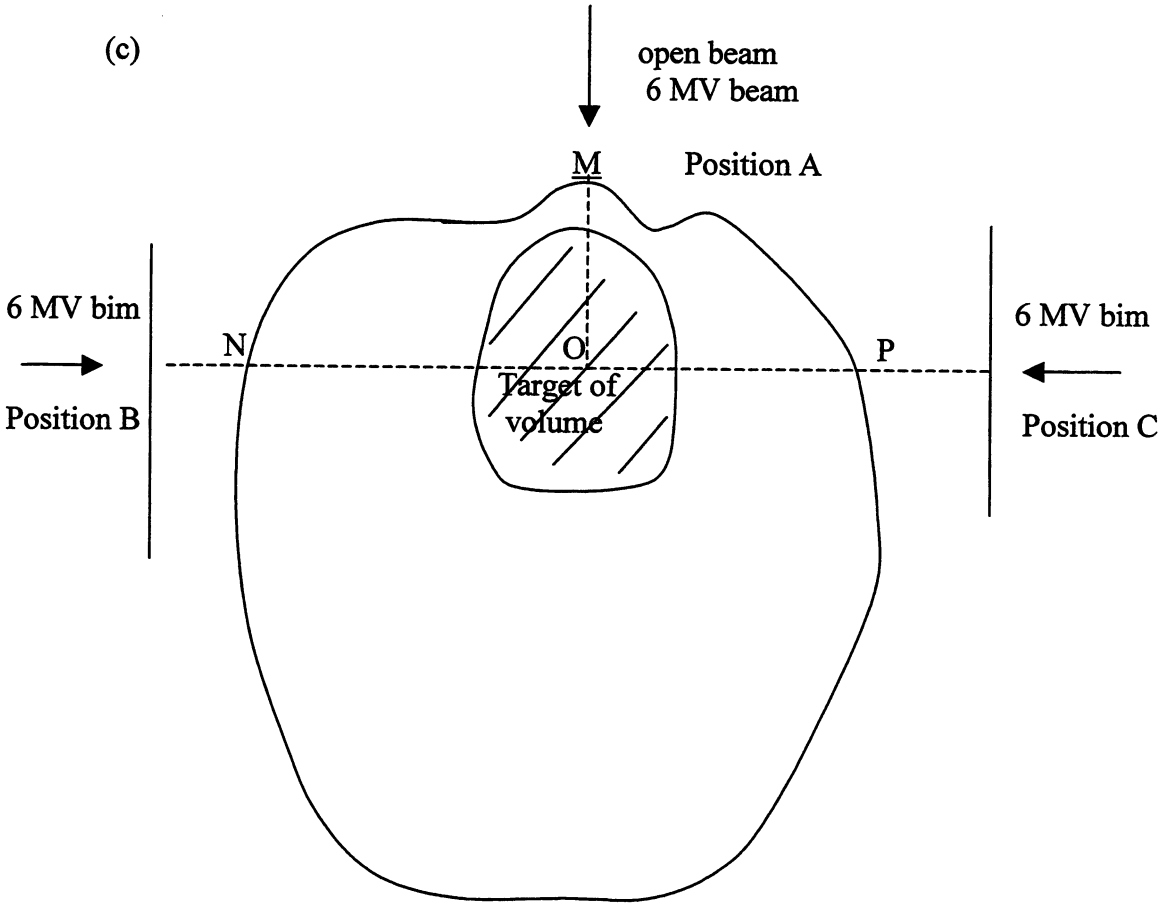
(30/100)

(b) Compare and contrast the factors that influence percentage depth dose and TPR.

[(b) Bandingkan dan bezakan faktor-faktor yang mempengaruhi peratus kedalaman dan TPR.

(30/100)

(c)



MO = 8 cm NO = OP = 10 cm

(i) Indicate the appropriate orientation of the wedges at positions B and C.

(i) Tentukan kedudukan yang sesuai bagi 'wedge' pada kedudukan B dan C.

(ii) Give two reasons why wedges are essential to achieve a uniform dose distribution in the target volume.

[(ii) Berikan dua sebab mengapa 'wedge' diperlukan supaya taburan dos seragam didapati dalam isipadu sasaran.]

(iii) The patient is treated with 3 beams of 6 MV, each at 100 cm SAD. Isocentre is at position O in the target. The field size at each position is 6×10 cm^2 at isocentre. The wedge factor is 0.6. If 100 monitor units are qpplied to each beam, calculate the total dose at point O.

[(iii) Seorang pesakit dirawati dengan 3 bim 6 MV, setiapnya pada SAD 100 cm. Pusat isocentre letak di 0 dalam sasaran. Saiz medan pada setiap kedudukan adalah 6×10 cm^2 pada isocentre. Faktor wedgenya 0.6. Jika 100 MU di beri dari setiap bim, hitungkan jumlah dos pada O.]

(40/100)

2. (a) Describe the physical aspects of the Manchester system for brachytherapy of carcinoma of the cervix. Include a discussions of distribution of sources, dose prescription points and critical organs.

[(a) Huraikan aspek fizik sistem Manchester bagi brakiterapi untuk 'carcinoma pada cervix'. Dalam perbincangan, sertakan taburan sumber, dose prescription points dan organ penting (critical organs).

(40/100)

(b) Describe a technique for the manufacture of irregularly shaped building blocks for MV Xray treatments. Howe may the use of such blocks affect the calculation of dose distribution and dose monitor settings.

(b) Huraikan teknik untuk membina blok yang bentuk tak regular untuk rawatan MV sinar-X. Nyatakan kesan penggunaan blok pada perhitungan taburan dos dan dose monitor setting.

(30/100)

(c) Compare the folowing:
[(c) Bandingkan:]

(i) bolus and compensating filter
[(i) bolus dan 'compensating filter']

(ii) multileaf collimator and field block
[(ii) multileaf collimator dan blok medan]

(30/100)

3. Briefly describe
[Jelaskan secara ringkas]

(a) the importance of Bateman Equation (10/100)
[(a) kepentingan Persamaan Bateman]

(b) the condition for secular equilibrium, transient equilibrium and no equilibrium
[(b) keadaan bagi keseimbangan sekular, keseimbangan transien dan tiada keseimbangan

(30/100)

(c) two (2) methods of producing Mo-99
[(c) dua (2) kaedah menghasilkan Mo-99] (30/100)

(d) the operation of Mo-99/Tc-99m generator and sketch the graph of daughter activity versus time for this generator
[(d) operasi generator Mo-99/Tc-99m dan lakarkan graf keaktifan anal melawan masa bagi generator ini

(30/100)

4. In radioisotope imaging using gamma camera briefly describe
[Dalam imejan radioisotop menggunakan kamera gamma secara ringkas jelaskan]

(a) secondary radiation produced inside the patient
[(a) sinaran sekunder yang dihasilskan di dalam tubuh pesakit]

(20/100)

(b) three (3) factors that contribute to the image quality in planer imaging
[(b) tiga (3) faktor yang mempengaruhi kualiti imej dalam imejan mensatah]

(30/100)

(c) the clinical SPECT procedure
[(c) prosedur SPECT klinikal]

(20/100)

(d) three (3) factors that affect the quality of SPECT images
[(d) tiga (3) faktor yang mempengaruhi kualiti imej SPECT]

(30/100)

5. (a) Briefly explain the physical and biological factors in the source organ that will contribute to the dose in the target organ.
[(a) Jelaskan secara ringkas faktor fizikal dan biologi di dalam organ sumber yang memberi sumbangan kepada dos di dalam organ sasar.]

(30/100)

(b) 10 mCi of Tc-99m+DTPA was injected into the patient for kidney study. Over a period of 30 minutes from injection time 60% of the total radiopharmacuetical injected was accumulated in the kidney and was cleared to the bladder with effective half life of 30 minutes. Assumming that the uptake by kidney was linear with time, calculate the mean dose of the kidney due to activity in the kidney. Given that S (kid-kid) = 0.0048 rad/microCurie/day.
[(b) 10 mCi of Tc-99m+DTPA *telah disuntik kepada pesakit untuk ujian buah pinggang. Dalam masa 30 minit selepas suntikan 60% daripada jumlah radiofarmasuetikal telah berada di dalam buah pinggang. Selepas itu keaktifan berpindah ke pundi kencing dengan separuh hayat efektif 30 minit. Andaikan pengambilan radiofarmasuetikal oleh buah pinggang adalah secara linear dengan masa, kirakan dos di dalam buah pinggang disebabkan keaktifan yang wujud di dalam buah pinggang. Diberikan* S (kid-kid) = 0.0048 rad/mikroCurie/hari.*]*

(70/100)

Table 11-4 Output factors

Output factor for PDD calculations (Sc, Sp)

Mach/Eq Sq	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0	35.0
Cobalt 60	0.928	0.945	0.962	0.971	0.980	0.990	1.000	1.009	1.019	1.028	1.037	1.046	1.053	1.060	1.067	1.074	1.081	1.089	1.096	1.102	1.105	1.109		
6 MV	0.927	0.940	0.954	0.967	0.979	0.990	1.000	1.007	1.014	1.021	1.028	1.035	1.039	1.044	1.049	1.053	1.058	1.065	1.072	1.079	1.084	1.088	1.092	1.098
10 MV	0.925	0.938	0.953	0.967	0.979	0.990	1.000	1.005	1.011	1.016	1.022	1.027	1.032	1.037	1.041	1.046	1.051	1.058	1.065	1.069	1.071	1.073	1.077	1.081
18 MV	0.904	0.922	0.941	0.961	0.976	0.988	1.000	1.007	1.014	1.021	1.028	1.036	1.041	1.046	1.051	1.056	1.060	1.067	1.073	1.079	1.084	1.087	1.090	1.093

Output factor for TAR calculations (Sc)

Mach/Eq Sq	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0	35.0
Cobalt 60	0.946	0.961	0.975	0.981	0.987	0.993	1.000	1.006	1.012	1.018	1.024	1.030	1.035	1.039	1.044	1.048	1.053	1.057	1.061	1.063	1.063	1.063		
6 MV	0.948	0.961	0.970	0.979	0.987	0.994	1.000	1.004	1.008	1.013	1.017	1.021	1.024	1.028	1.031	1.035	1.038	1.041	1.045	1.048	1.051	1.052	1.053	1.055
10 MV	0.938	0.951	0.962	0.973	0.982	0.991	1.000	1.005	1.009	1.014	1.018	1.023	1.026	1.030	1.033	1.037	1.040	1.044	1.048	1.051	1.052	1.054	1.057	1.061
18 MV	0.914	0.931	0.948	0.965	0.978	0.989	1.000	1.006	1.012	1.017	1.023	1.029	1.032	1.036	1.039	1.043	1.046	1.052	1.057	1.063	1.066	1.067	1.069	1.070

Table 11-5 Output factors

Phantom scatter factor for TMR and TPR calculations (Sp)

Mach/Eq Sq	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0	35.0
Cobalt 60	0.981	0.983	0.987	0.990	0.993	0.997	1.000	1.003	1.007	1.010	1.013	1.016	1.017	1.020	1.022	1.025	1.027	1.030	1.033	1.037	1.040	1.043		
6 MV	0.978	0.978	0.984	0.988	0.992	0.996	1.000	1.003	1.006	1.008	1.011	1.014	1.015	1.016	1.017	1.017	1.019	1.023	1.026	1.030	1.031	1.034	1.037	1.041
10 MV	0.986	0.986	0.991	0.994	0.997	0.999	1.000	1.000	1.002	1.002	1.004	1.004	1.006	1.007	1.008	1.009	1.011	1.013	1.016	1.017	1.018	1.018	1.019	1.019
18 MV	0.989	0.990	0.993	0.996	0.998	0.999	1.000	1.001	1.002	1.004	1.005	1.007	1.009	1.010	1.012	1.012	1.013	1.014	1.015	1.015	1.017	1.019	1.020	1.021

Table 11-7 6 MV percentage depth dose at 100 cm SSD

Eq Sq / Depth (cm)	0.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0	35.0
0.0	19.2	19.2	19.2	20.5	21.8	23.0	24.3	25.6	26.7	27.9	29.1	30.2	31.4	32.6	33.8	35.1	36.3	37.5	39.0	40.4	41.9	43.2	44.5	45.7	47.6
1.0	96.8	96.9	96.9	97.0	97.0	97.0	97.1	97.1	97.2	97.2	97.3	97.3	97.4	97.4	97.5	97.5	97.6	97.6	97.7	97.8	98.0	98.1	98.1	98.2	98.3
1.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2.0	97.4	98.2	98.4	98.4	98.5	98.5	98.6	98.6	98.6	98.6	98.6	98.6	98.6	98.6	98.6	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7
3.0	91.1	93.8	94.4	94.7	94.9	95.0	95.0	95.1	95.1	95.1	95.2	95.2	95.2	95.3	95.3	95.4	95.4	95.5	95.5	95.6	95.6	95.6	95.6	95.6	95.5
4.0	85.3	89.6	90.6	90.9	91.3	91.4	91.5	91.5	91.5	91.6	91.6	91.7	91.7	91.8	91.9	92.0	92.1	92.2	92.2	92.3	92.4	92.3	92.3	92.3	92.2
5.0	79.9	84.5	85.6	86.1	86.6	86.8	87.0	87.1	87.3	87.5	87.7	87.8	87.9	88.1	88.2	88.3	88.5	88.6	88.7	88.8	89.0	89.0	89.0	89.0	88.9
6.0	74.8	79.7	80.9	81.5	82.1	82.4	82.7	83.0	83.2	83.5	83.8	84.0	84.1	84.3	84.5	84.7	84.8	85.0	85.2	85.4	85.6	85.6	85.7	85.8	85.7
7.0	70.1	75.1	76.3	77.1	77.8	78.3	78.7	79.0	79.3	79.6	79.9	80.3	80.4	80.6	80.8	81.0	81.2	81.4	81.7	82.0	82.2	82.3	82.4	82.5	82.3
8.0	65.7	70.8	72.1	72.9	73.7	74.2	74.7	75.1	75.5	75.9	76.2	76.6	76.8	77.0	77.3	77.5	77.8	77.9	78.3	78.6	78.8	78.9	79.0	79.1	79.0
9.0	61.5	66.7	68.0	68.9	69.8	70.4	71.0	71.4	71.8	72.2	72.6	73.0	73.2	73.5	73.8	74.1	74.3	74.5	74.9	75.3	75.5	75.6	75.8	76.0	75.7
10.0	57.7	62.8	64.1	65.1	66.1	66.7	67.4	67.8	68.3	68.8	69.2	69.6	69.8	70.1	70.5	70.8	71.0	71.2	71.6	72.0	72.3	72.5	72.7	72.8	72.6
11.0	54.0	59.2	60.4	61.5	62.4	63.1	63.8	64.2	64.8	65.3	65.8	66.1	66.4	66.8	67.1	67.5	67.7	67.9	68.4	68.8	69.0	69.2	69.4	69.6	69.3
12.0	50.7	55.7	57.0	58.0	58.9	59.7	60.4	60.9	61.4	61.9	62.4	62.8	63.1	63.5	63.9	64.3	64.5	64.8	65.3	65.8	66.0	66.2	66.4	66.5	66.2
13.0	47.5	52.4	53.6	54.6	55.6	56.4	57.2	57.7	58.2	58.8	59.3	59.7	60.0	60.4	60.8	61.2	61.5	61.7	62.2	62.7	63.0	63.2	63.4	63.5	63.3
14.0	44.6	49.4	50.6	51.6	52.5	53.3	54.1	54.6	55.1	55.7	56.3	56.6	57.0	57.4	57.8	58.2	58.5	58.8	59.4	59.9	60.1	60.3	60.6	60.6	60.4
15.0	41.8	46.6	47.8	48.7	49.6	50.5	51.2	51.7	52.3	52.9	53.5	53.9	54.2	54.7	55.1	55.5	55.8	56.1	56.6	57.1	57.4	57.6	57.9	57.8	57.6
16.0	39.2	43.9	45.1	46.0	46.9	47.8	48.5	49.1	49.7	50.3	50.9	51.2	51.6	52.0	52.5	52.8	53.1	53.4	54.0	54.5	54.8	55.1	55.4	55.2	55.1
17.0	36.8	41.4	42.5	43.5	44.3	45.2	45.9	46.4	47.1	47.7	48.2	48.6	49.0	49.4	49.9	50.2	50.6	50.9	51.5	52.0	52.3	52.6	52.9	52.7	52.6
18.0	34.5	39.0	40.1	41.0	41.9	42.7	43.4	44.0	44.6	45.3	45.8	46.2	46.6	47.0	47.5	47.8	48.2	48.5	49.1	49.6	49.9	50.2	50.5	50.3	50.2
19.0	32.4	36.8	37.8	38.7	39.6	40.5	41.1	41.7	42.3	43.0	43.5	43.9	44.3	44.7	45.1	45.5	45.8	46.1	46.8	47.2	47.6	48.0	48.2	48.0	47.9
20.0	30.4	34.6	35.7	36.6	37.4	38.2	38.9	39.5	40.1	40.7	41.2	41.6	42.0	42.5	42.9	43.2	43.6	43.9	44.6	45.0	45.4	45.7	45.9	45.8	45.6
21.0	28.6	32.7	33.7	34.5	35.3	36.1	36.8	37.4	38.0	38.6	39.1	39.5	39.9	40.3	40.7	41.1	41.4	41.8	42.4	42.9	43.2	43.6	43.7	43.6	43.5
22.0	26.8	30.8	31.8	32.6	33.4	34.2	34.8	35.4	36.0	36.9	37.1	37.5	37.9	38.3	38.7	39.1	39.4	39.8	40.4	40.8	41.2	41.6	41.7	41.6	41.5
23.0	25.2	29.1	30.0	30.8	31.6	32.4	33.0	33.6	34.2	34.8	35.2	35.6	36.0	36.4	36.8	37.2	37.5	37.9	38.5	38.9	39.3	39.7	39.8	39.6	39.5
24.0	23.6	27.5	28.4	29.1	29.9	30.6	31.2	31.8	32.4	32.9	33.4	33.7	34.1	34.6	35.0	35.3	35.7	36.0	36.7	37.1	37.5	37.9	37.8	37.7	37.6
25.0	22.2	26.0	26.8	27.6	28.3	29.0	29.6	30.1	30.7	31.3	31.7	32.0	32.4	32.9	33.2	33.6	33.9	34.3	34.9	35.3	35.7	36.1	36.0	35.9	35.8
26.0	20.9	24.5	25.3	26.0	26.7	27.4	27.9	28.5	29.1	29.6	30.0	30.4	30.8	31.2	31.5	31.9	32.2	32.6	33.2	33.6	34.0	34.4	34.3	34.2	34.1
27.0	19.6	23.2	24.0	24.7	25.3	26.0	26.5	27.0	27.6	28.1	28.4	28.8	29.2	29.6	30.0	30.3	30.7	31.0	31.6	32.0	32.4	32.7	32.6	32.6	32.4
28.0	18.4	21.9	22.6	23.3	24.0	24.6	25.1	25.6	26.1	26.6	26.9	27.3	27.7	28.1	28.4	28.8	29.2	29.5	30.1	30.5	30.9	31.1	31.1	31.0	30.9
29.0	17.3	20.7	21.4	22.0	22.7	23.3	23.7	24.2	24.7	25.2	25.6	25.9	26.3	26.7	27.0	27.4	27.7	28.1	28.6	29.0	29.4	29.6	29.5	29.5	29.4
30.0	16.2	19.5	20.2	20.8	21.4	22.0	22.4	22.9	23.4	23.8	24.2	24.6	24.9	25.3	25.7	26.0	26.4	26.7	27.2	27.6	28.0	28.1	28.0	28.0	27.9
																								PDD 6 MV	
PSF	1.000	1.002	1.003	1.007	1.012	1.016	1.021	1.025	1.028	1.031	1.033	1.036	1.039	1.040	1.041	1.043	1.044	1.045	1.048	1.051	1.054	1.057	1.060	1.063	1.067

Table 11-14 6 MV tissue maximum ratio

Eq Sq / Depth (cm)	0.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0	35.0
0.0	0.186	0.187	0.186	0.199	0.210	0.223	0.235	0.248	0.259	0.271	0.282	0.293	0.304	0.316	0.329	0.339	0.352	0.364	0.378	0.392	0.406	0.419	0.431	0.443	0.461
1.0	0.957	0.958	0.958	0.958	0.958	0.959	0.959	0.960	0.960	0.960	0.962	0.962	0.962	0.963	0.963	0.964	0.964	0.965	0.966	0.968	0.969	0.970	0.970	0.971	0.972
1.5	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.0	0.982	0.990	0.991	0.992	0.992	0.993	0.993	0.993	0.993	0.993	0.994	0.994	0.993	7.692	0.994	0.994	0.994	0.994	0.995	0.995	0.995	0.995	0.995	0.994	0.994
3.0	0.936	0.964	0.970	0.972	0.974	0.975	0.976	0.977	0.977	0.977	0.978	0.978	0.978	7.692	0.980	0.979	0.980	0.981	0.981	0.982	0.982	0.982	0.982	0.981	0.981
4.0	0.894	0.938	0.948	0.952	0.955	0.957	0.957	0.958	0.958	0.958	0.959	0.959	0.960	7.692	0.962	0.963	0.964	0.965	0.966	0.966	0.967	0.967	0.967	0.966	0.966
5.0	0.853	0.901	0.912	0.918	0.922	0.926	0.927	0.929	0.930	0.932	0.934	0.936	0.937	7.692	0.940	0.942	0.943	0.944	0.946	0.948	0.949	0.949	0.949	0.949	0.949
6.0	0.814	0.865	0.877	0.884	0.889	0.895	0.897	0.900	0.903	0.905	0.909	0.911	0.913	7.692	0.917	0.556	0.920	0.922	0.925	0.927	0.929	0.931	0.931	0.931	0.933
7.0	0.777	0.829	0.842	0.851	0.858	0.864	0.868	0.872	0.875	0.879	0.882	0.885	0.888	7.692	0.893	0.895	0.898	0.900	0.903	0.905	0.908	0.910	0.910	0.912	0.913
8.0	0.742	0.796	0.810	0.818	0.827	0.834	0.838	0.844	0.847	0.852	0.856	0.860	0.863	7.692	0.869	0.871	0.874	0.877	0.880	0.883	0.886	0.888	0.890	0.890	0.892
9.0	0.708	0.763	0.777	0.786	0.795	0.804	0.809	0.816	0.820	0.824	0.829	0.833	0.837	7.692	0.843	0.847	0.850	0.853	0.857	0.860	0.864	0.867	0.868	0.869	0.872
10.0	0.676	0.732	0.745	0.756	0.766	0.775	0.782	0.788	0.793	0.797	0.803	0.808	0.812	7.692	0.819	0.822	0.826	0.829	0.833	0.837	0.842	0.844	0.846	0.848	0.851
11.0	0.645	0.701	0.714	0.725	0.735	0.744	0.751	0.759	0.765	0.769	0.775	0.780	0.785	7.692	0.793	0.796	0.800	0.804	0.808	0.813	0.817	0.820	0.823	0.824	0.828
12.0	0.616	0.671	0.684	0.695	0.706	0.716	0.723	0.731	0.736	0.742	0.747	0.753	0.758	7.692	0.767	0.771	0.775	0.779	0.784	0.789	0.794	0.798	0.800	0.802	0.805
13.0	0.588	0.642	0.655	0.666	0.676	0.686	0.694	0.703	0.709	0.715	0.721	0.727	0.732	7.692	0.742	0.745	0.750	0.754	0.760	0.765	0.770	0.774	0.776	0.779	0.783
14.0	0.561	0.615	0.628	0.639	0.648	0.658	0.667	0.676	0.682	0.688	0.695	0.701	0.706	7.692	0.716	0.720	0.724	0.729	0.736	0.741	0.748	0.751	0.754	0.756	0.760
15.0	0.536	0.589	0.602	0.613	0.623	0.620	0.642	0.651	0.657	0.663	0.670	0.677	0.682	7.692	0.693	0.696	0.701	0.706	0.713	0.718	0.725	0.729	0.732	0.735	0.739
16.0	0.511	0.564	0.577	0.588	0.598	0.607	0.617	0.626	0.633	0.639	0.647	0.653	0.659	7.692	0.670	0.673	0.678	0.683	0.690	0.696	0.703	0.708	0.710	0.713	0.718
17.0	0.488	0.541	0.553	0.564	0.574	0.584	0.593	0.602	0.609	0.615	0.622	0.628	0.635	7.692	0.646	0.650	0.655	0.660	0.667	0.674	0.680	0.686	0.689	0.692	0.697
18.0	0.466	0.517	0.529	0.540	0.550	0.560	0.569	0.579	0.586	0.593	0.599	0.606	0.613	7.692	0.623	0.628	0.633	0.638	0.645	0.653	0.659	0.665	0.668	0.672	0.677
19.0	0.445	0.495	0.507	0.517	0.528	0.537	0.547	0.556	0.563	0.570	0.577	0.584	0.591	7.692	0.601	0.606	0.611	0.616	0.623	0.631	0.638	0.643	0.647	0.651	0.657
20.0	0.424	0.473	0.486	0.496	0.506	0.516	0.524	0.534	0.541	0.548	0.555	0.562	0.569	7.692	0.579	0.584	0.589	0.594	0.602	0.609	0.617	0.623	0.626	0.630	0.636
21.0	0.405	0.454	0.466	0.476	0.484	0.494	0.502	0.512	0.519	0.527	0.533	0.541	0.548	7.692	0.558	0.563	0.568	0.573	0.581	0.588	0.596	0.602	0.606	0.611	0.616
22.0	0.387	0.434	0.446	0.456	0.464	0.474	0.483	0.492	0.499	0.506	0.513	0.520	0.527	7.692	0.538	0.543	0.548	0.553	0.561	0.568	0.576	0.582	0.587	0.591	0.598
23.0	0.370	0.416	0.428	0.437	0.446	0.456	0.464	0.473	0.480	0.487	0.494	0.501	0.508	7.692	0.518	0.523	0.529	0.534	0.541	0.549	0.557	0.563	0.568	0.572	0.579
24.0	0.352	0.398	0.410	0.419	0.428	0.436	0.445	0.454	0.460	0.468	0.474	0.482	0.488	7.692	0.499	0.503	0.509	0.514	0.522	0.530	0.538	0.544	0.549	0.553	0.560
25.0	0.337	0.382	0.393	0.402	0.410	0.419	0.427	0.436	0.443	0.449	0.456	0.463	0.470	7.692	0.480	0.485	0.490	0.496	0.504	0.512	0.520	0.526	0.530	0.535	0.543
26.0	0.321	0.365	0.376	0.384	0.393	0.402	0.409	0.418	0.424	0.431	0.439	0.445	0.451	7.692	0.462	0.466	0.471	0.477	0.485	0.493	0.501	0.507	0.512	0.516	0.524
27.0	0.307	0.350	0.361	0.369	0.377	0.386	0.394	0.402	0.408	0.414	0.421	0.428	0.434	7.692	0.444	0.449	0.454	0.459	0.468	0.476	0.484	0.490	0.495	0.500	0.507
28.0	0.292	0.335	0.346	0.355	0.362	0.370	0.377	0.385	0.392	0.398	0.405	0.410	0.417	7.692	0.427	0.431	0.436	0.441	0.449	0.459	0.467	0.473	0.478	0.483	0.490
29.0	0.279	0.321	0.332	0.340	0.344	0.355	0.362	0.370	0.375	0.382	0.388	0.395	0.400	7.692	0.410	0.415	0.420	0.425	0.433	0.441	0.450	0.457	0.461	0.466	0.473
30.0	0.266	0.307	0.317	0.325	0.332	0.340	0.347	0.354	0.360	0.366	0.373	0.378	0.384	7.692	0.394	0.399	0.403	0.409	0.417	0.425	0.434	0.440	0.444	0.450	0.456

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